641

GAS JOURNAL

LIGHT . HEAT . POWER . BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. 202. 85th Year. LONDON, JUNE 7, 1933. No. 3655. Price 2s.

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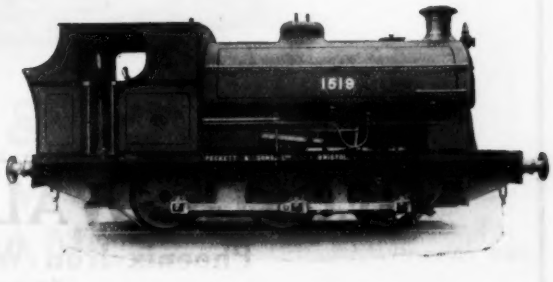
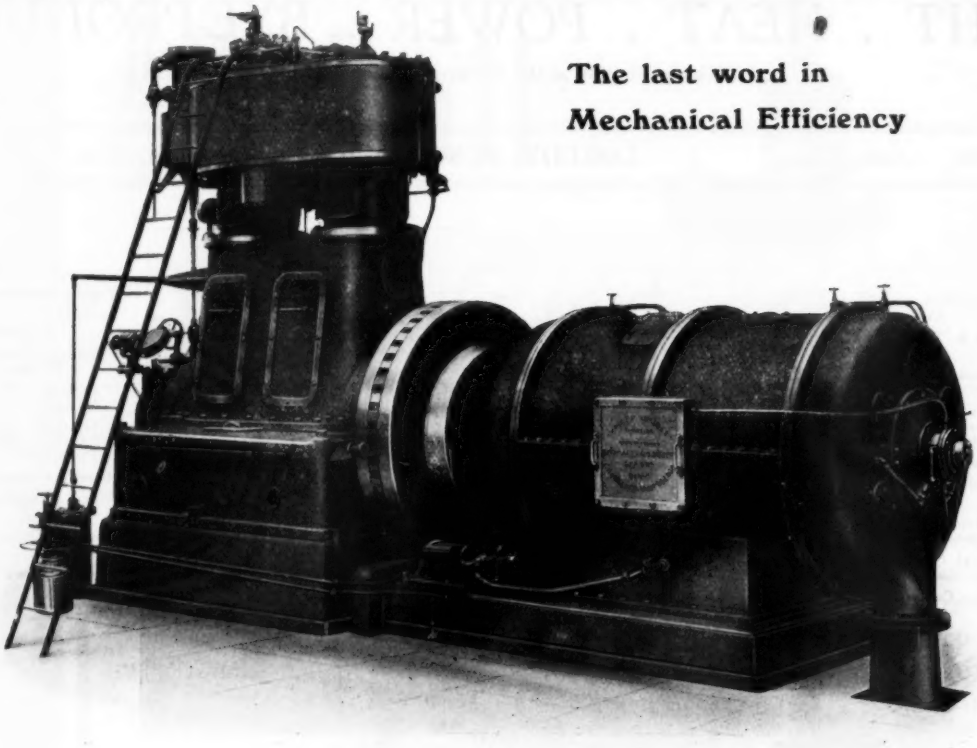


CRANKLESS COMPRESSORS

The last word in
Mechanical Efficiency



Steam Driven Michell Crankless Gas Compressor, 350,000 c.ft. per hour, 20 lbs. pressure.

THE Michell Machine has been designated the "Rolls Royce" of Gas Compressors. Here we illustrate a Compressor of this type driven by High Speed Steam Engine. The outstanding advantages of the Crankless Compressor, apart from its very high mechanical efficiency, are:—

Small space, and consequently small building foundation.
Wide variation of speed and volume.
Perfect balance, eliminating vibration.
Constant pressure with varying volumes.
High speed and steady discharge.
A positive machine without crank or connecting rods and their attendant bearings.
Equally suitable for Direct Electric Drive.
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Designed for any discharge pressure.
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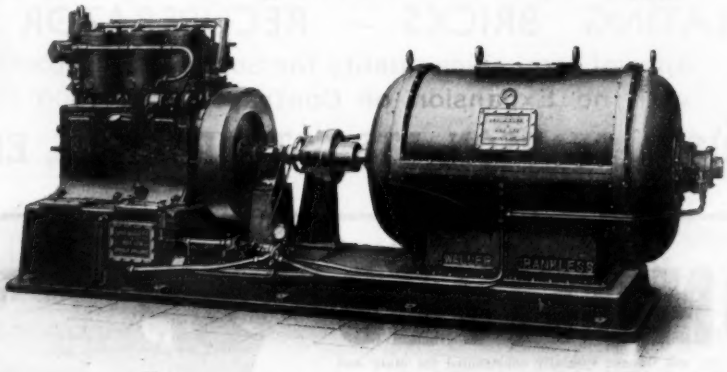

Gas Engine Driven Unit, 200,000 c.ft. per hour, 7½ lbs. pressure.

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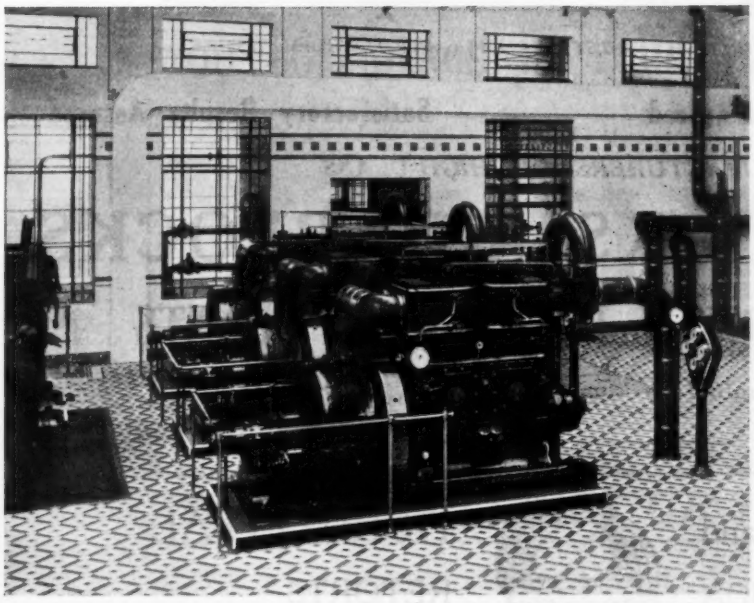

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The large surplus of steam available in modern gas producing installations makes the use of steam engines for all power requirements the most economical proposition.

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Minimum of Expansion Guaranteed. **Satisfactory Results Assured.**

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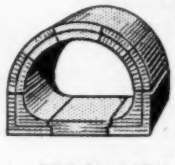
To any Design. ***As Supplied to some of the Largest Works in the Country.***

VERTICAL and SILICA  HORIZONTAL RETORTS

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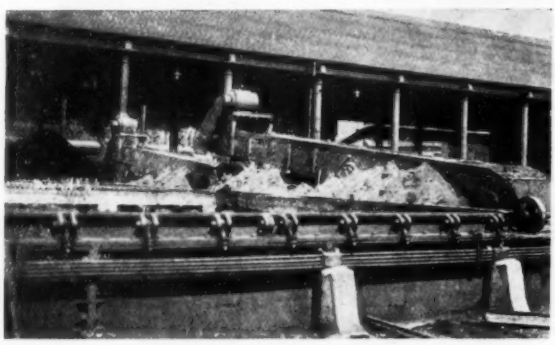
OXIDE BREAKING & HANDLING PLANTS

A C & T BREAKER AT LIVERPOOL (Athol St.).

OXIDE BREAKERS

The Liverpool Gas Company has 4 C & T Oxide Breakers, 1 at Athol Street, 2 at Garston and 1 at Wavertree. The C & T Breaker is chosen for its efficient operation, sturdy construction and long life. Capacities range from 2 to 60 tons per hour.



2 C & T CONVEYORS AT STOKE-ON-TRENT.

OXIDE CONVEYORS

The 2 C & T Conveyors shown here are at work at the Stoke-on-Trent Gas Works. These Machines make a very substantial saving in time and labour both in discharging and re-charging boxes.

A C & T STACKER AT STRETFORD.

PORTABLE STACKERS

By using the Machine shown here at the Stretford Gas Works a large excavation was completed in almost half the time allowed in the estimate. It is also used for loading Coke and Oxide. 4 men can take this Machine anywhere. Capacity 20 tons Oxide/hr.

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RECIPROCATING GAS COMPRESSORS

High Speed, Vertical, Steam Driven.

AUTOMATIC CONTROL, OPERATED BY GAS PRESSURE. EASY ACCESSIBILITY TO WORKING PARTS.—ROBUST CONSTRUCTION AND OF THE VERY LATEST DESIGN.—AUTOMATIC SUCTION AND DELIVERY VALVES.—PERFECT BALANCE, ENSURING ABSENCE OF VIBRATION AT HIGH SPEEDS. — BEARINGS AND ALL WORKING PARTS OF AMPLE PROPORTIONS, GIVING ABSENCE OF WEAR AND ENSURING LONG LIFE.

For Pressures up to 100 lbs. per sq. inch.

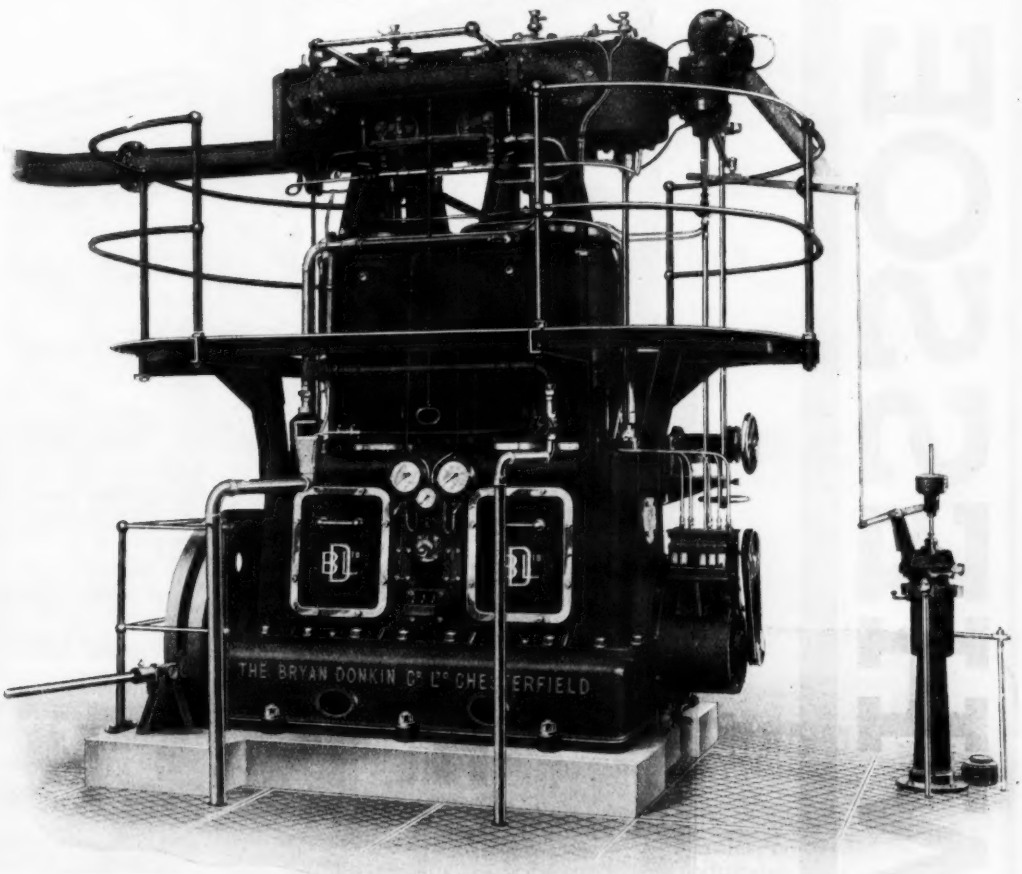

Fig. 813.—Steam driven Vertical High Speed Duplex type, fitted with forced lubrication to all bearings. Capacity 120,000 cubic feet of gas per hour, against gas pressures up to 30 lbs., with steam pressures up to 150 lbs. per sq. inch and running at 350 r.p.m.

Can also be supplied driven by Gas Engine, Electric Motor or Belt.

These Compressors are the IDEAL Machines for the GRID Scheme for High Pressure Gas transmission.

We are also Makers of

GAS REGULATORS and GOVERNORS for high and low pressures
HIGH PRESSURE DISTRICT GOVERNORS (Reynolds' Patent)
RATEAU TURBO EXHAUSTERS, BOOSTERS and COMPRESSORS
GAS VALVES, Single and Double faced, for high and low pressures

THE BRYAN DONKIN CO. LTD.

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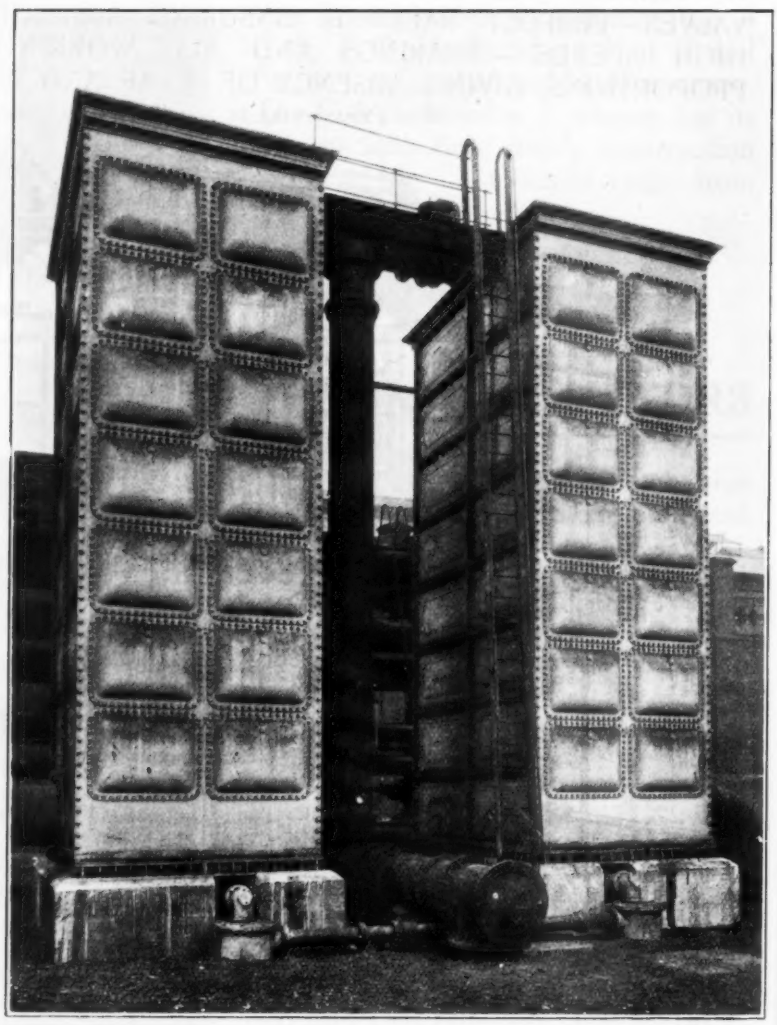
PLANT THAT IS TECHNICALLY CORRECT



SERVICE . . .

The Whessoe Company's products are briefly listed on the opposite page. Each item from this list is fully serviced. The Whessoe service is to supply plant that is technically correct and structurally sound. The Whessoe service includes materials, workmanship, and performance all of the highest order. It is part of the Whessoe service to send highly skilled staffs to erect and to make certain that the operation of whatever Whessoe product is installed proves reliable and efficient. The Whessoe service extends to taking its part in the proper maintenance of the completed work throughout its life.

THE WHESSOE FOUNDRY & ENGINEERING COMPANY LTD.

PRODUCTS

Serving THE GAS INDUSTRY

ELECTRO DETARRERS

The W.W-D (Whessoe Woodall-Duckham) Electro Detarrers are the acme of efficiency in the complete removal of tar fog from coal gas, coke oven gas, and all other fuel gases. English Electric High Tension Plant incorporated.

MECHANICAL DETARRERS

The W-Z Disintegrator, a mechanical washer for fog removal achieves high efficiencies but costs little to install. As an example, the W-Z Disintegrator is ideal for fine cleaning moderate volumes of producer gas.

DUST EXTRACTORS

Both the above processes—electrical precipitation and mechanical washing—have a wide field in dust extraction from all types of gases.

GASHOLDERS

Whessoe Gasholders are made at competitive prices—spiral and column guided, and pressure types. The number of Whessoe Gasholders in use and the reliability they give throughout years of service is their best testimonial.

PURIFIERS

Whessoe purifier work is noted for its completeness—complete houses and subsidiary equipment, extensions to existing installations. Separate boxes or conversions are competently carried out. The Whessoe Preheater is an inexpensive item which when installed will ensure maximum efficiency in purification.

WASHERS & SCRUBBERS

The Whessoe Rotary Washer-Scrubber remains the most outstanding machine for ammonia extraction and benzole scrubbing. Detailed improvements have notably increased the efficiency of the Whessoe Rotary—current reductions in price are still combined with the utmost reliability.

CONDENSERS

Almost as famous as the Whessoe Washer-Scrubber are the Whessoe Condensers. Scientific design ensures cooling to definite requirements—three types: Horizontal Water Tube, Vertical Water Tube, and the new Atmospheric Draught Condenser.

TANKS & PLATEWORKS

C.I. and Steel Tanks. Gas mains in welded or rivetted steel, bunkers, hoppers, chutes of all sizes at competitive prices. Liquor coolers and heat exchangers are also Whessoe specialities.

WEIGHBRIDGES

The number of gas companies, collieries, and other heavy industries that have Whessoe Weighbridges in use prove that these machines maintain their accuracy through years of hard service.

PLANT THAT IS STRUCTURALLY SOUND

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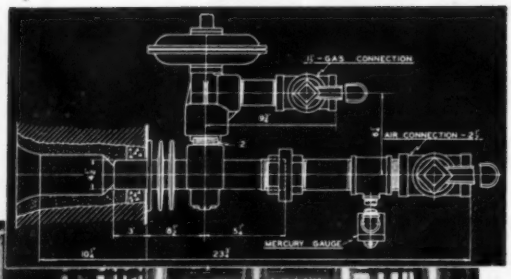
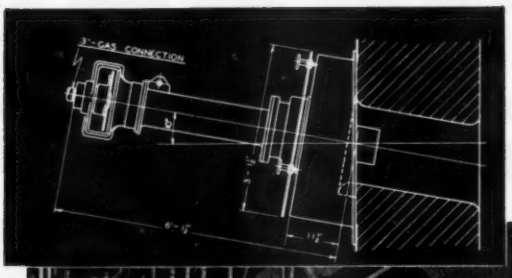
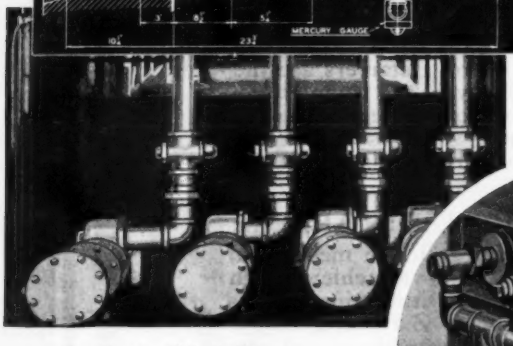
Full particulars of any Whessoe product will be promptly sent on request.

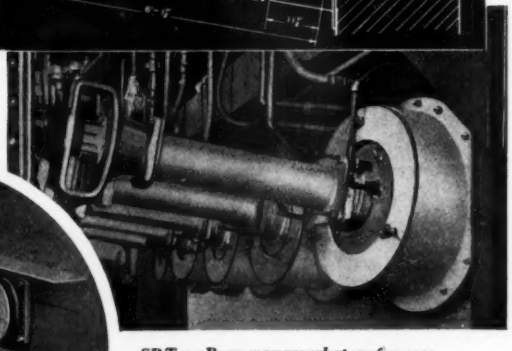
THE WHESSOE FOUNDRY & ENGINEERING COMPANY LTD.





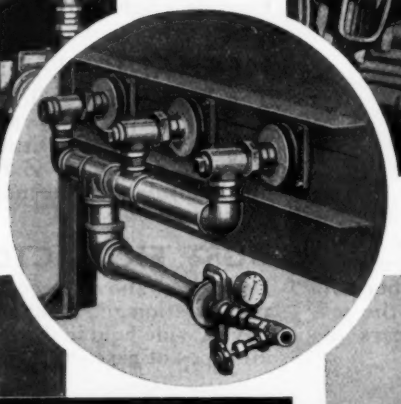


High Pressure Inspirator manifolded to Three Tunnel Burners.



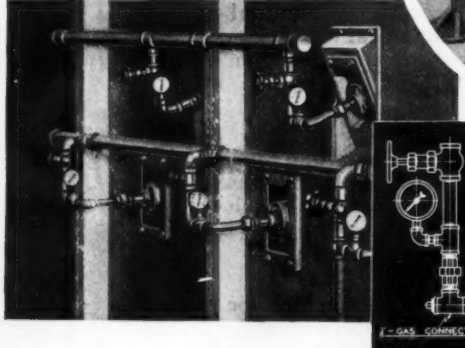
Low Pressure Velocity Burners.

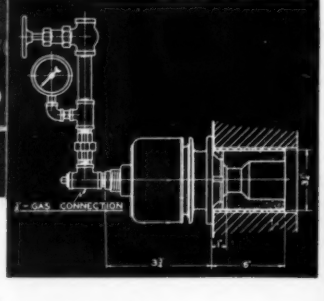
Two-Stage High Pressure Velocity Burners.

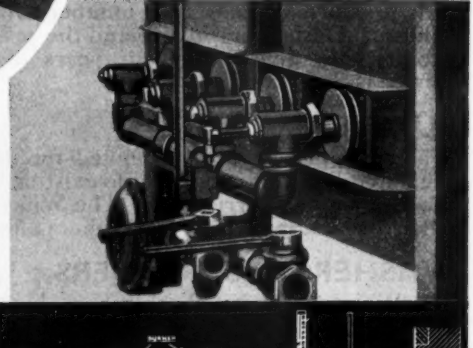


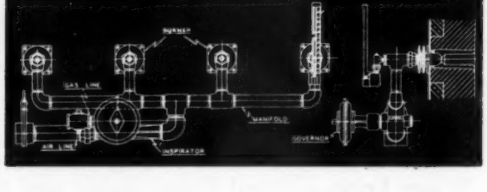
SR Type Burner on reverbatory furnace.

Low Pressure Inspirator manifolded to Tunnel Burners.









20 Cu. Ft. or 30,000 Cu. Ft. of gas per hour?

IT makes no difference what hourly capacity, there is an SC Automatic Proportioning Gas Burner for your job.

Because no one type of burner can handle all applications, SC Burners are built in 46 different types and more than 400 different sizes. You are thereby assured of the correct type and size for your particular application.

Furthermore, in any SC Burner installation you get correct proportioning of air and gas—automatically maintained with one valve control. You get the advice of our engineers based on many years of experience in gas burning equipment. Consult them on your burner applications—in any size, or any type.

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Let this Consumer tell you why *she* prefers the `NEW WORLD´ COOKER...

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Sirs,

May I tender to you an appreciation of your "New World" and say that it is the finest gas cooker I have ever used and that it really does do what you claim for it.

We are a family of six adults and can only spend our Sundays together and like to spend these outdoors when it is fine, and each Sunday morning I prepare the dinner and while doing so heat up the oven and when ready place the dinner in and set dial at No. 4. We then go out and return at about 2.15 p.m. to find a perfectly cooked dinner ready to put on the table—excepting to make the gravy.

Last Sunday we had:—

1. Roast Lamb.
2. Cauliflower.
3. Roast Potatoes.
4. Boiled Potatoes.
5. Milk Pudding.
6. Rhubarb.

Not bad for a menu that wanted no looking after. We have, of course, had various other menus, but this is just a sample of what you can do.

Yours truly,

(Sgd.) Mrs. FLORENCE E. JONES.

Original letter
held by

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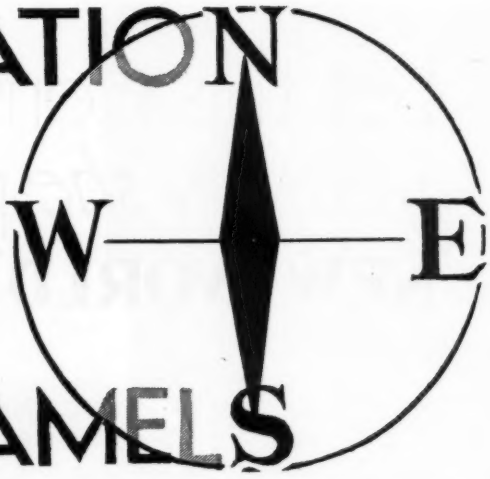
NO VARIATION



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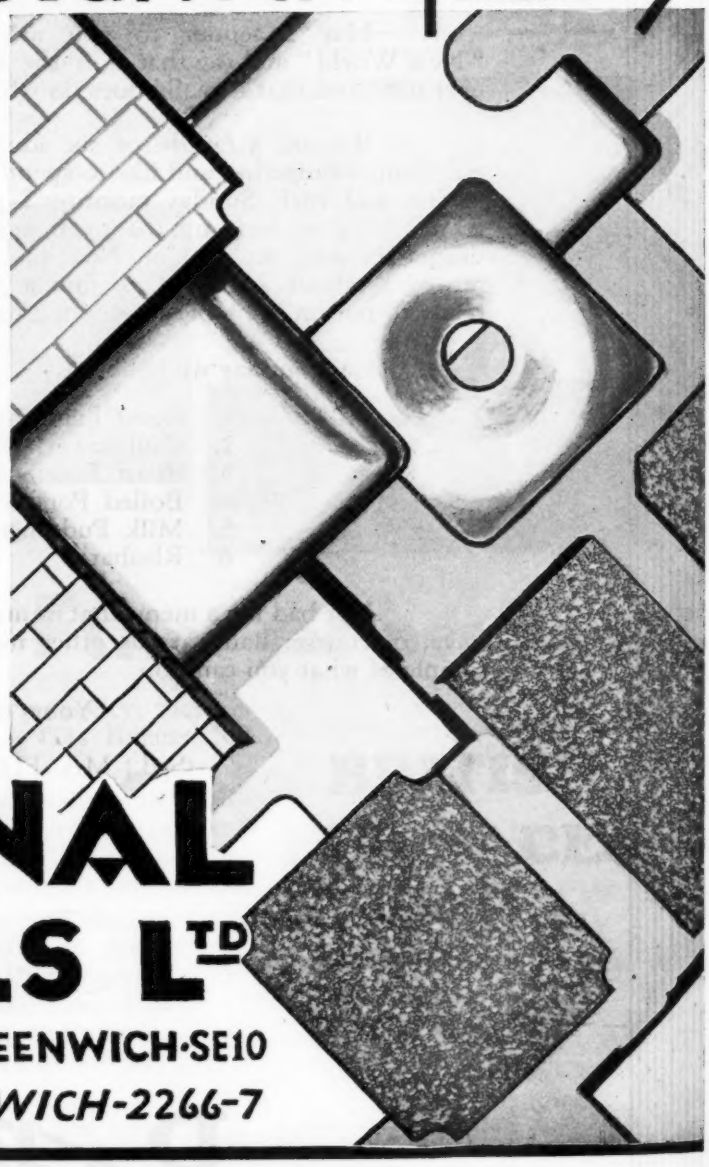
— constant in quality



Pursue the safest course and place your orders for heat-resisting enamelware with an undertaking which specializes in this class of work.

"Constancy" is our watchword, and our linings, trays, and splash plates are noted for their excellence of quality, workmanship, and design.

For further particulars apply—

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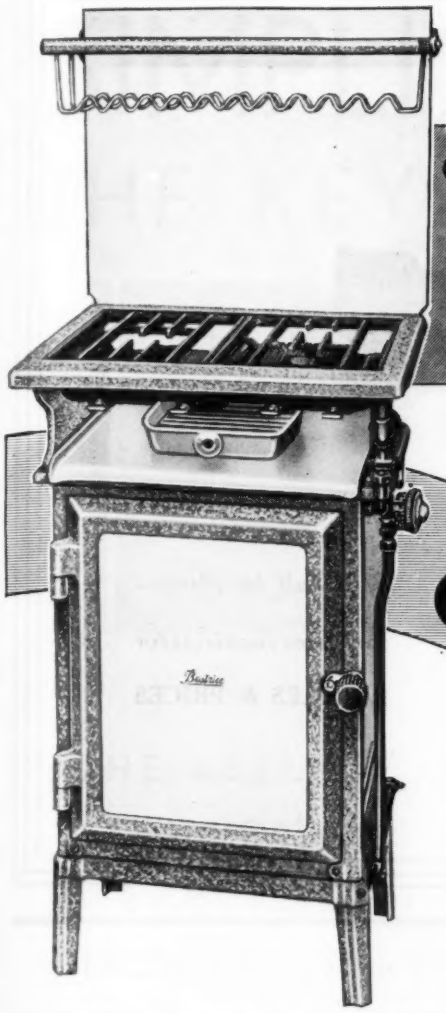


The New "BEATRICE" GAS COOKER Model No 33.

8 OUTSTANDING NEW FEATURES

ONE BURNER OVEN AND BOTTOM FLUE OUTLET.

ONE PIECE ALL STEEL GATES AND OVEN SHELVES.

MAXIMUM COOKING SPACE IN OVEN, WITH *NO PROJECTIONS AND CONSEQUENT EASE IN CLEANING.*

HOT PLATE BURNERS SPACED TO GIVE FULLEST EFFICIENCY.

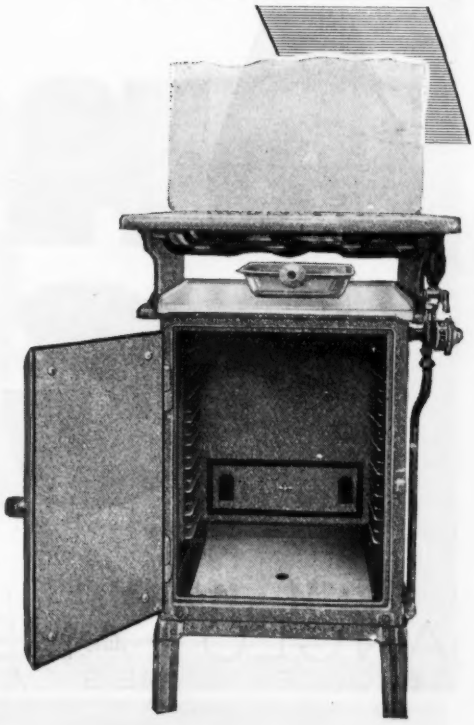
HOT PLATE BARS IN TWO SECTIONS ONLY AND CANNOT BE WRONGLY REPLACED.

OVEN AND DOOR LINED WITH CELLULAR ASBESTOS.

GREY MOTTLE AND WHITE ENAMEL FINISH AS SHOWN.

SPRING LOADED CHROMIUM PLATED TAPS. SAFETY SELF-LOCKING OVEN TAP.

Besides the Standard Finish (Grey Mottle) "Beatrice" Gas Cookers can now be obtained in Green or Blue "Snowdrift" Mottle Enamel.



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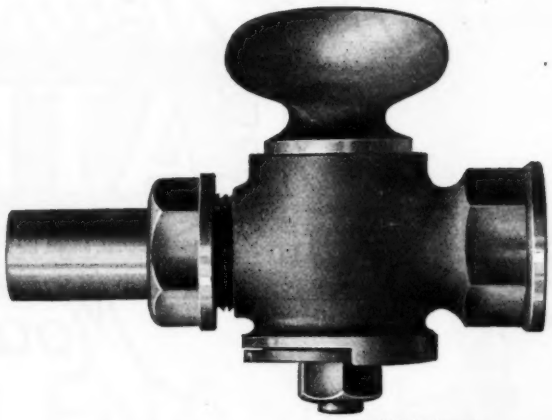
Quality



DESIGN No. 50

GUN-METAL MAIN COCKS

GEORGE ORME & CO.
(Branch of Meters Ltd.)
ATLAS METER WORKS
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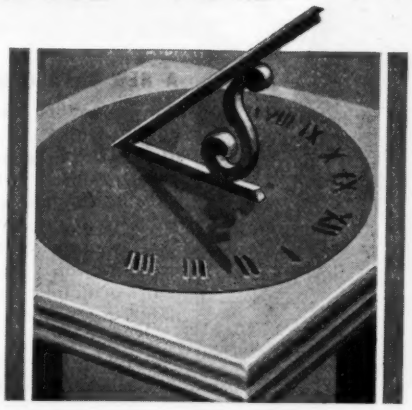
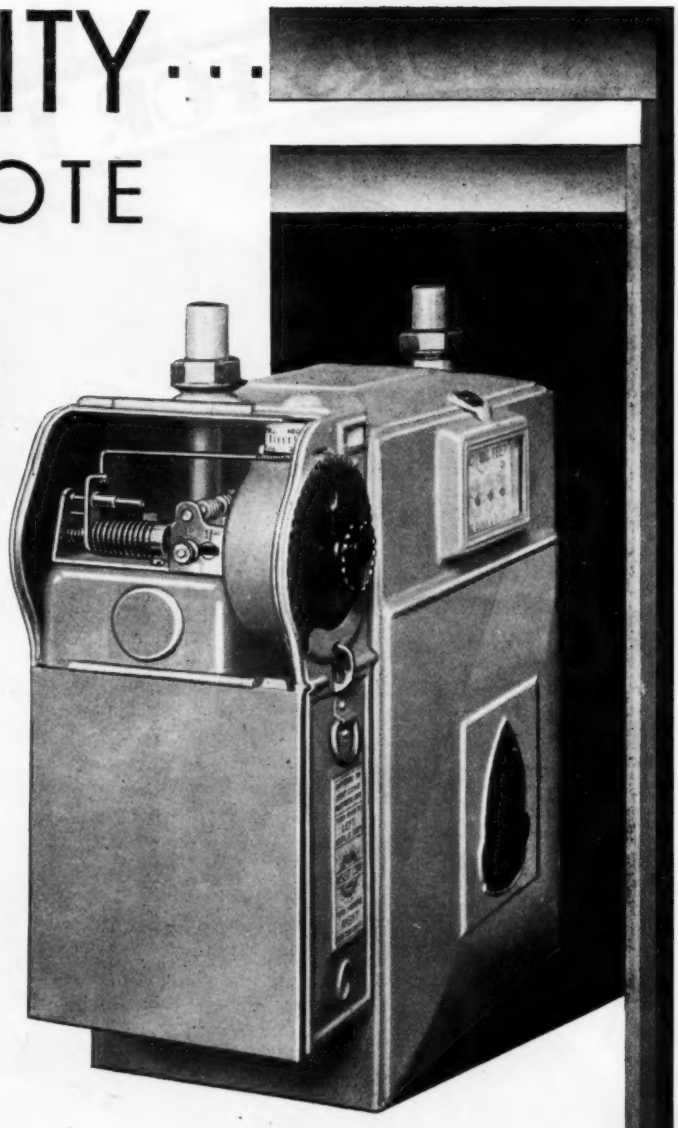
THE KEYNOTE





THE ABSENCE OF COMPLICATIONS IN GEARING IN THE THOMAS GLOVER PREPAYMENT MECHANISM MEANS . . . . . .

STRENGTH RIGIDITY AND ACCURACY

THOMAS GLOVER & Co LTD

ORIGINAL DRY GAS METER MAKERS

ESTABLISHED IN 1844

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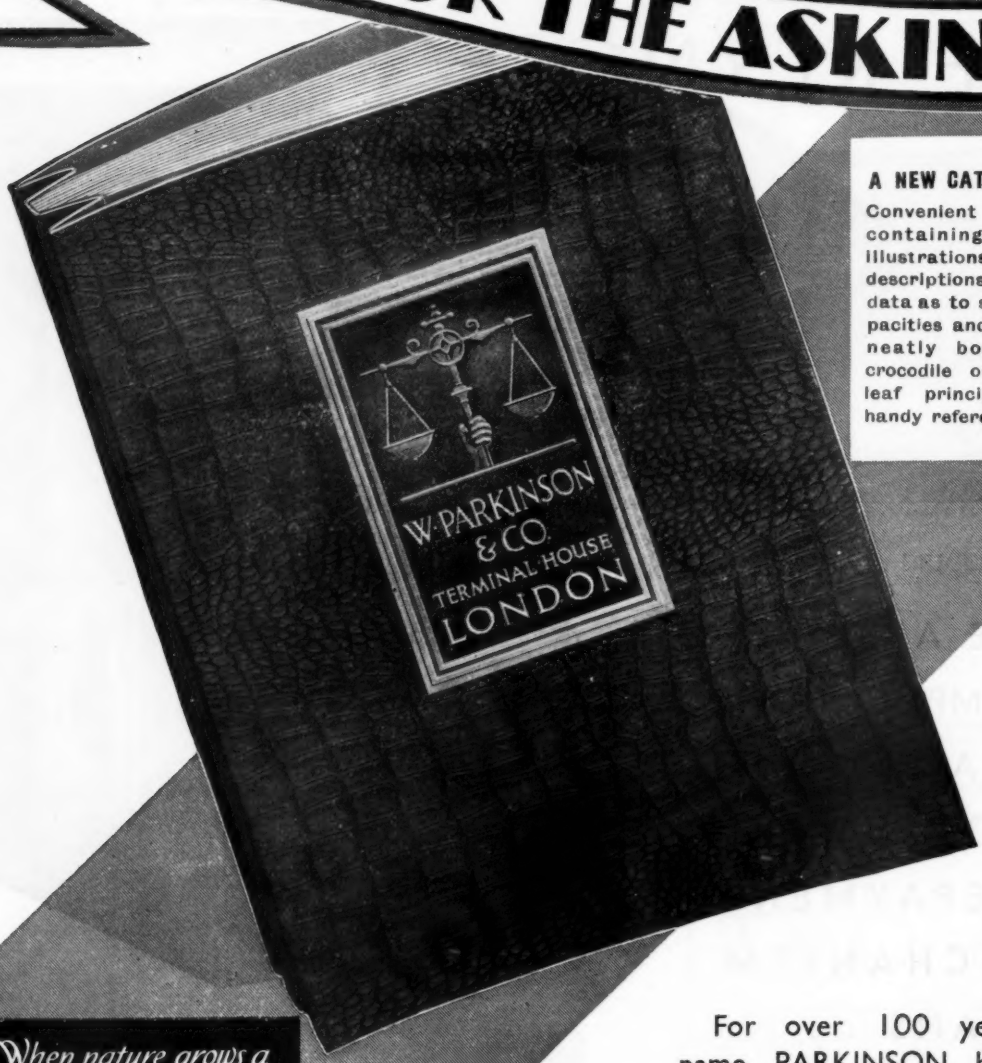

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'ASCOT' Gas Water Heaters

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Every Domestic

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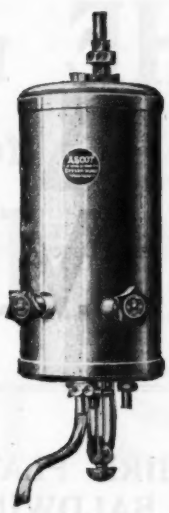

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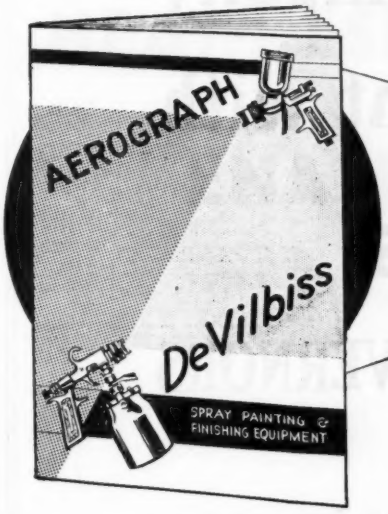

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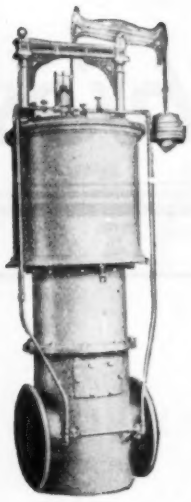

Fig. 29.
Pressure Loading.

The 18 inch, 24 inch, and 30 inch Peebles' Water Loaded Station Governors supplied last year to the Liverpool Gas Company have proved so satisfactory that we have received an order for four more; size 27 inch.

Apart from their sensitive regulation these Governors have the great advantage of being absolutely safe.

There is not the least risk of leakage. Fire hazard, with the further risk of explosion, is nil, for in no circumstances can the bell (which is totally enclosed) be tilted and gas escape.

You can ensure the security of your plant by installing Peebles' Enclosed Station Governors.

The enclosed safety principle applies to the following types of Peebles Gas Governors :— Station, Retort, District, and House Service. These are described and illustrated in Peebles' Gas Governor Catalogue. Copy on request.

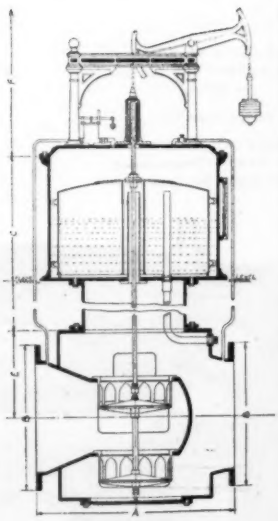

Fig. 28.
Water Loading.

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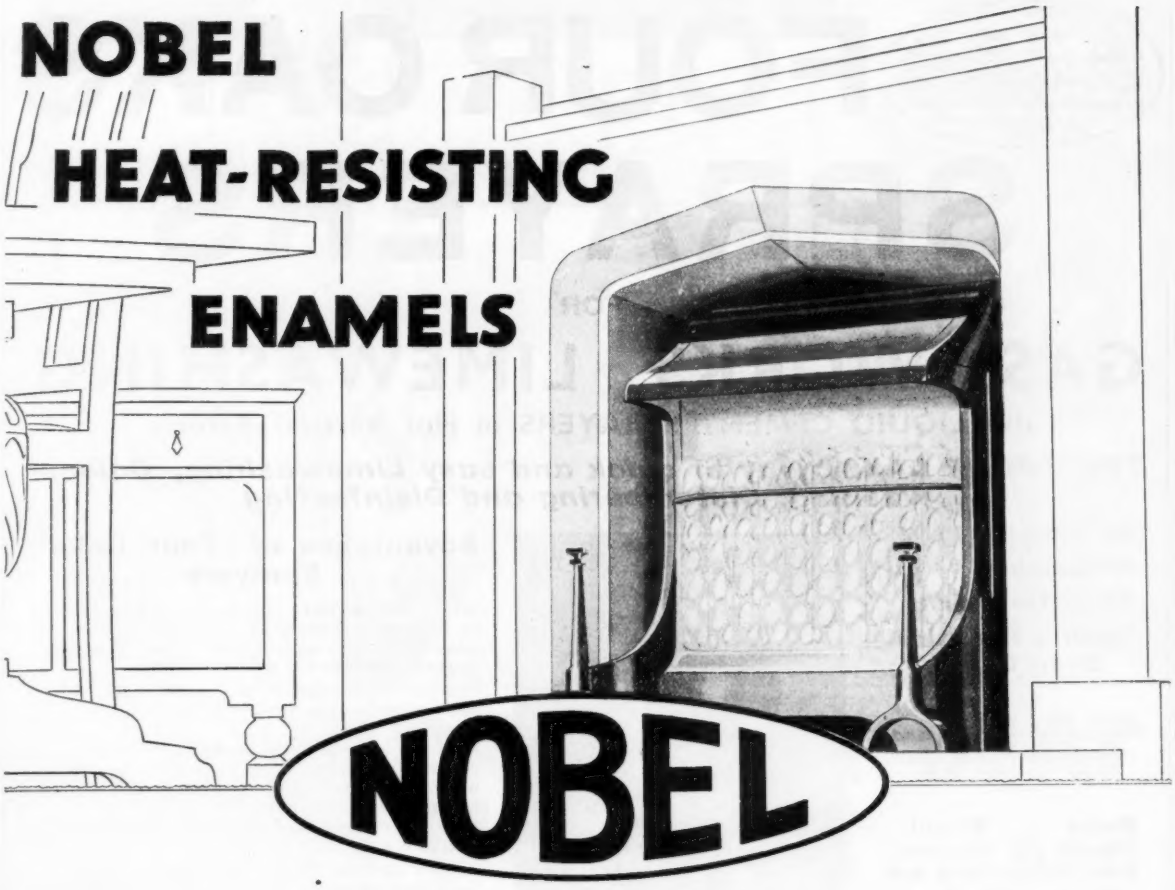

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The "FOUR OAKS" way of quick and easy Limewashing, Colour-washing, Distempering and Disinfecting

So Easy!
So Quick!
So Little Mess!
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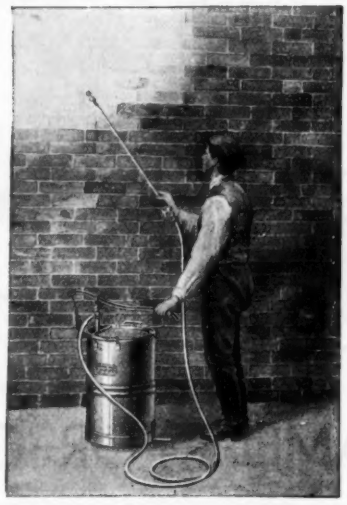

Illustration shows "**Wizard**" Pattern Limewashing a wall.

Price of "Wizard" Pattern, as illustrated (Capacity 6 gallons), and complete with 10 ft. rubber hose and two nozzles,

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With a "Four Oaks" Machine, 500 square feet can be beautifully limewashed in 10 minutes without splashing or inconvenience, and no scaffolding being necessary, reduces the risk of accidents.

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90 % of labour bill saved. All cost of scaffolding saved.

Work done **far better** than it could ever be done with brush, in one-tenth the time!

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Spare parts outfit for "Bridgwater" machine, Box D, **5/6** extra.

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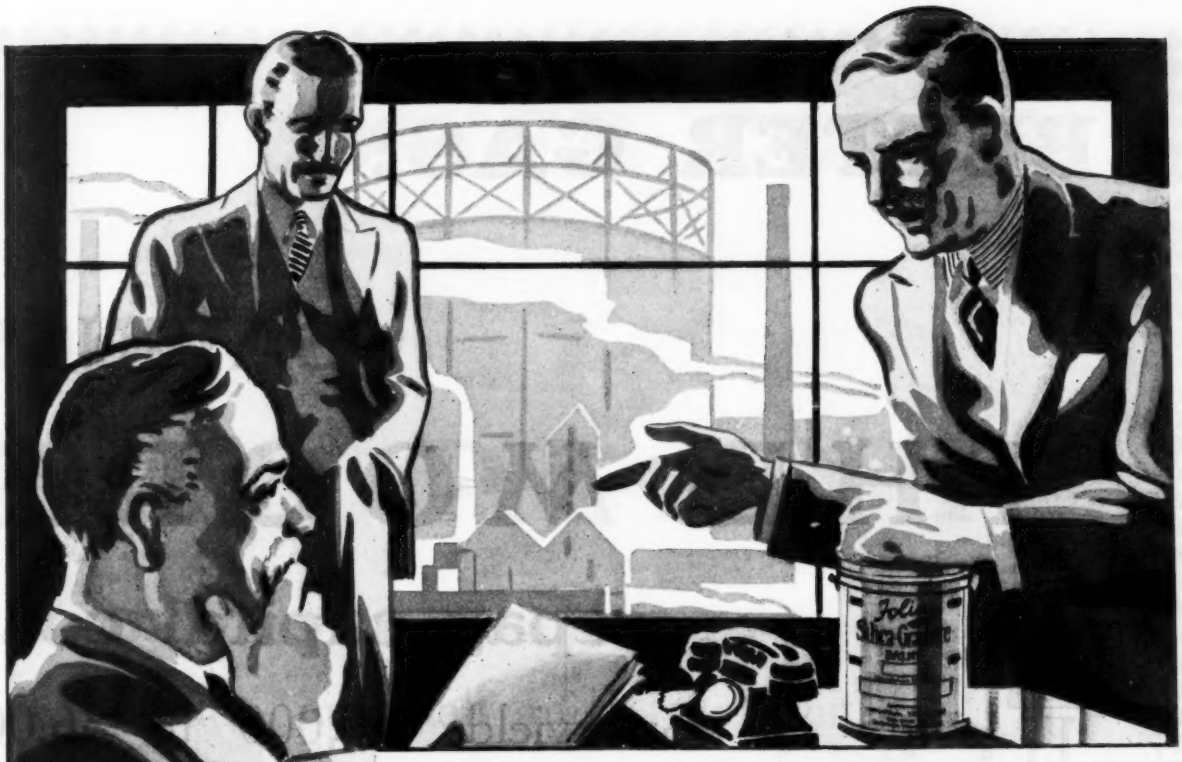
The "FOUR OAKS" Gold Medal "Bridgwater" Pattern

We can thoroughly recommend this Machine to Gas Managers who require a really good, powerful Machine.



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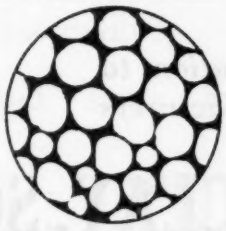
Foliac Silica-Graphite Paint is made up of flat flakes that overlap like slates on a roof, and pack into every hollow and crevice.



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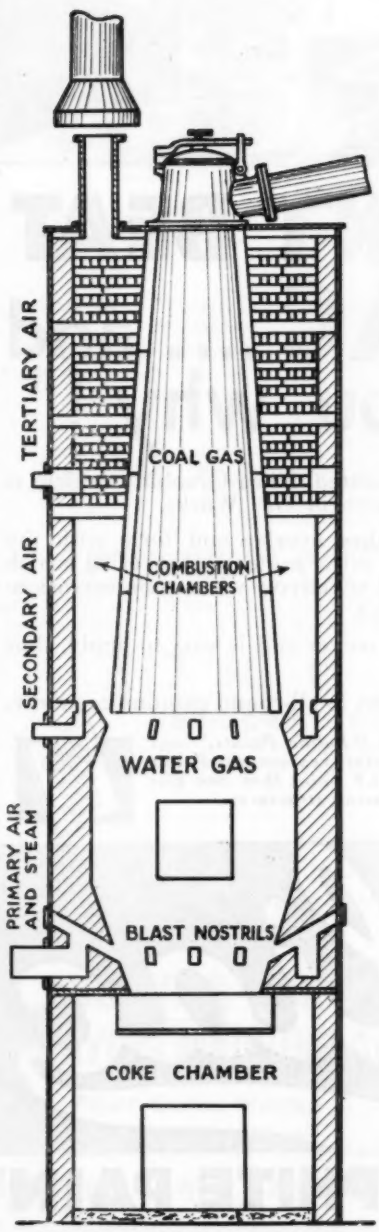

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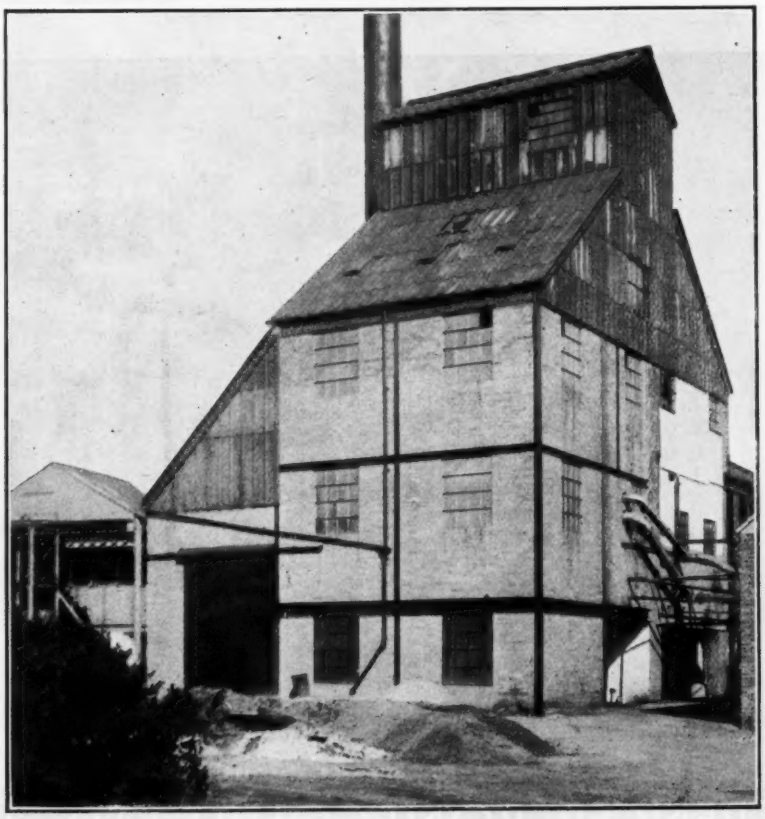

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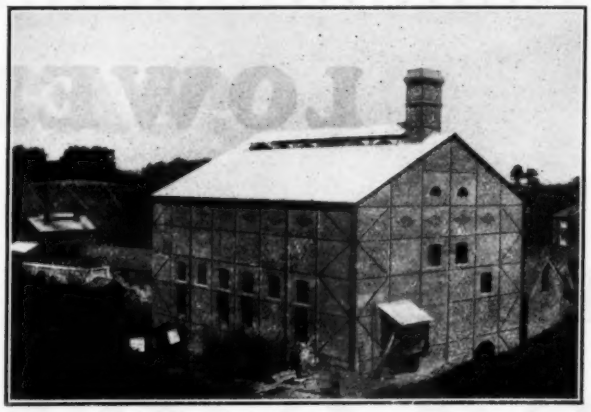

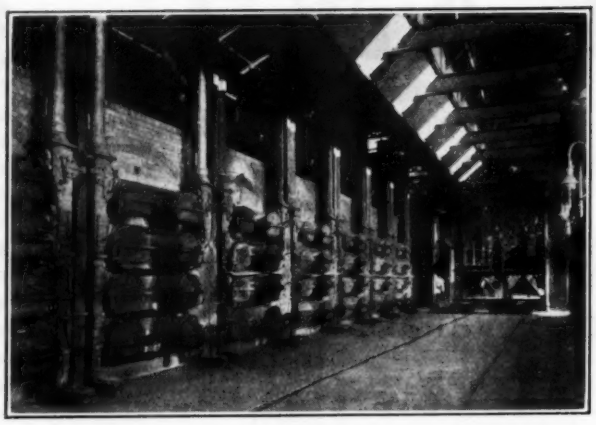

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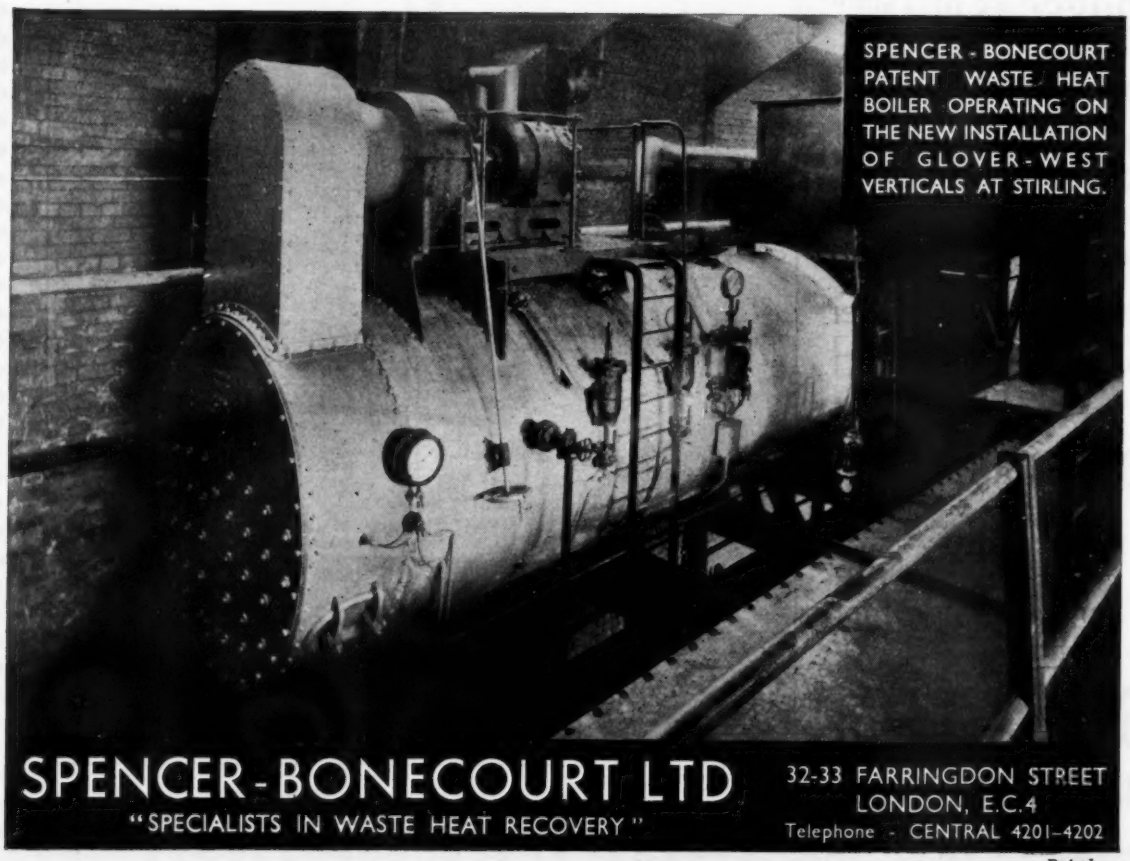

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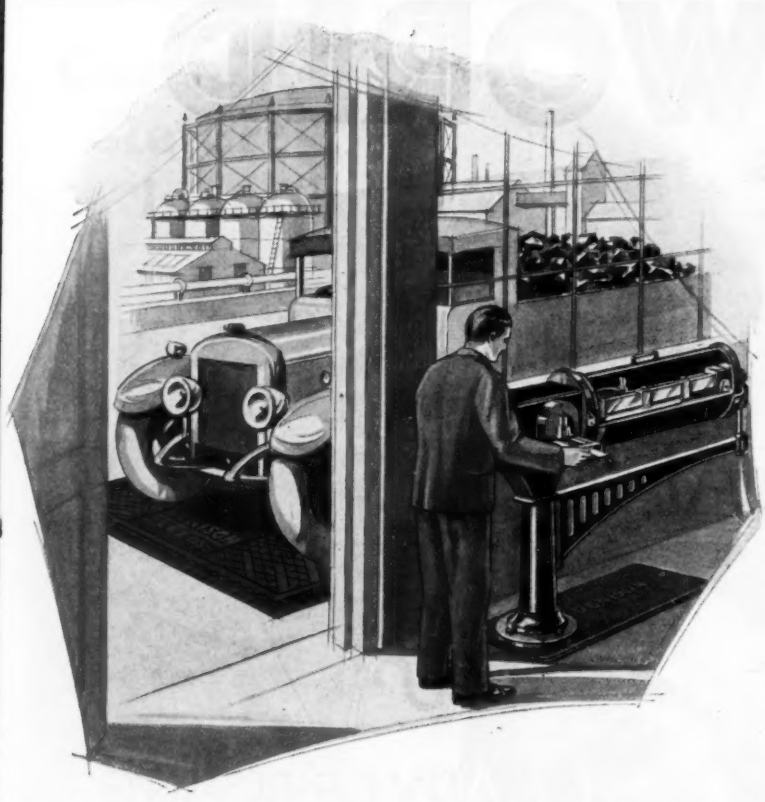

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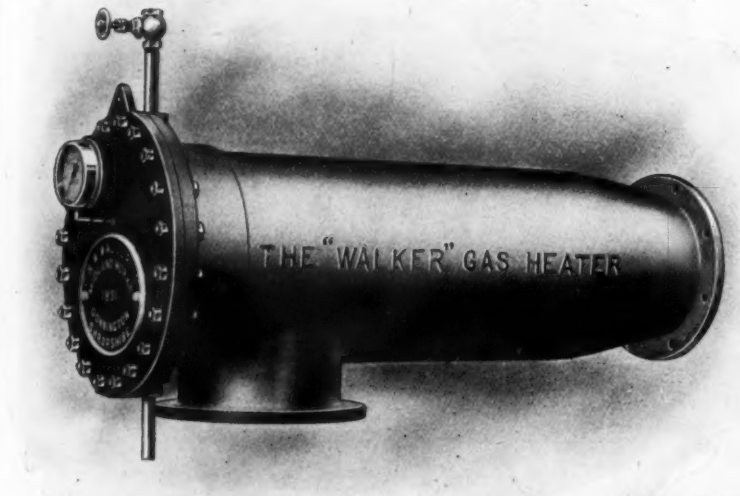

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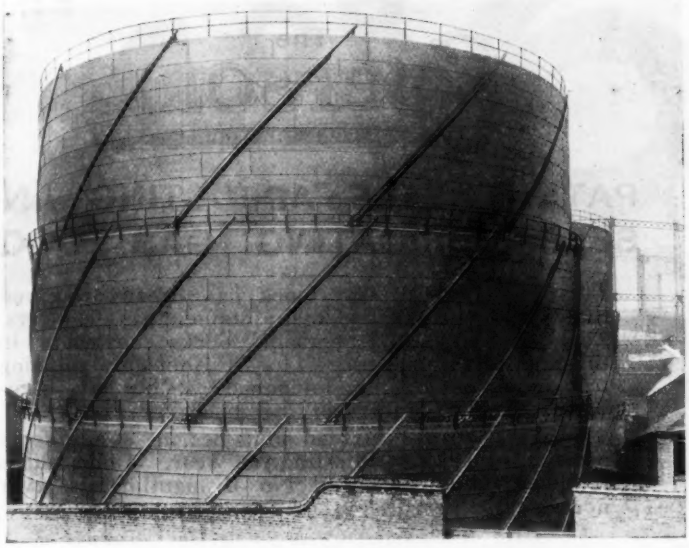

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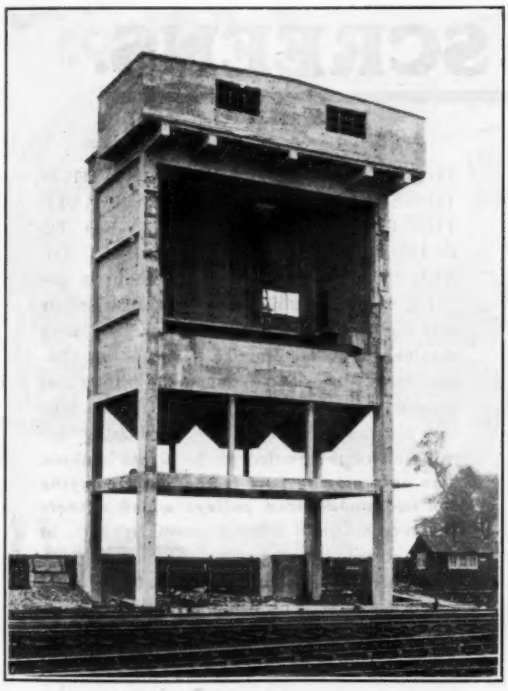

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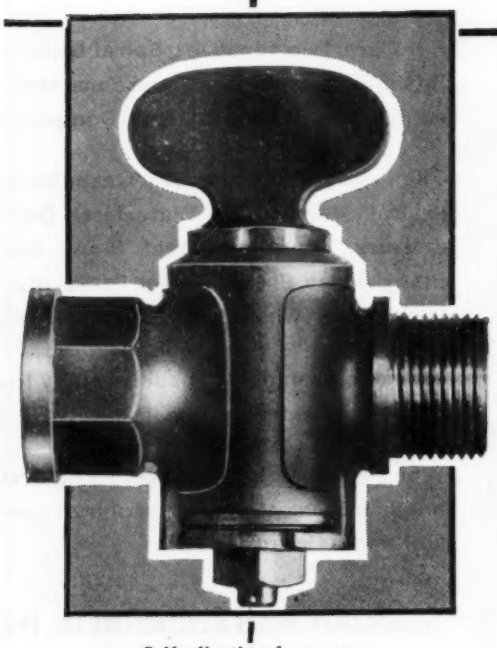

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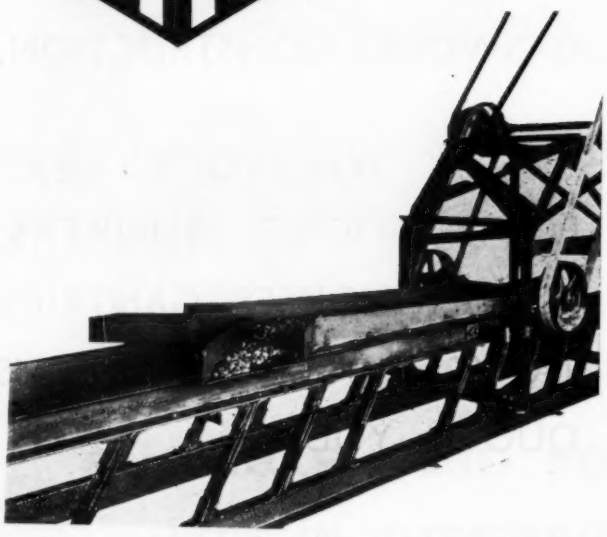

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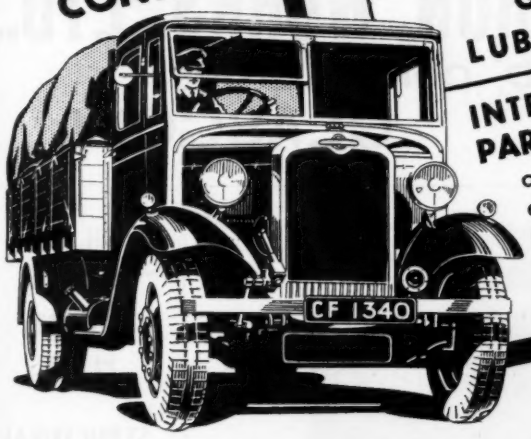

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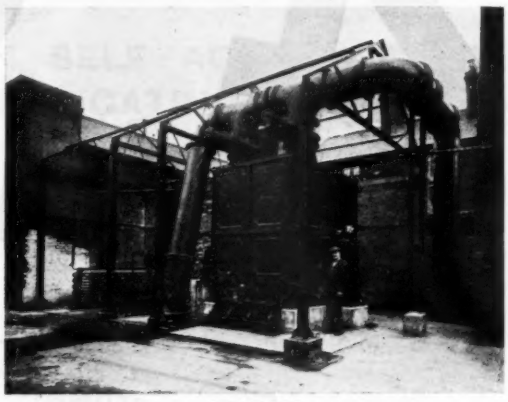

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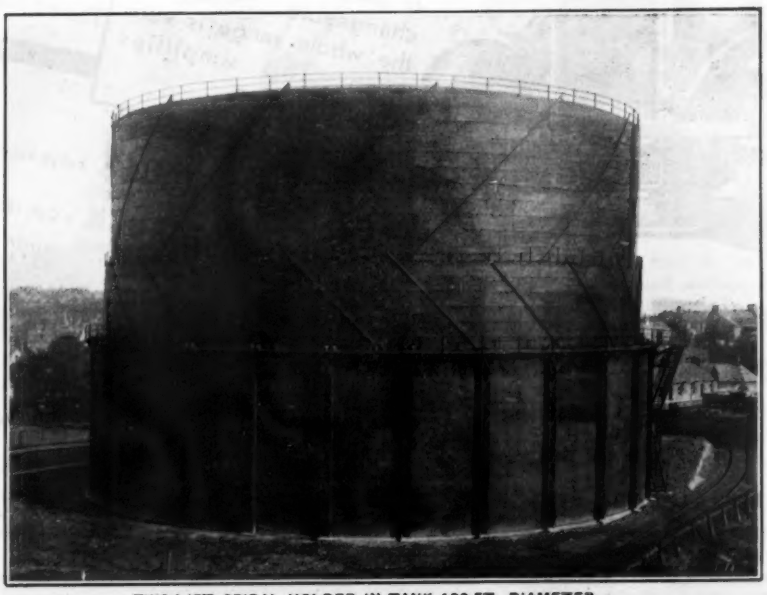

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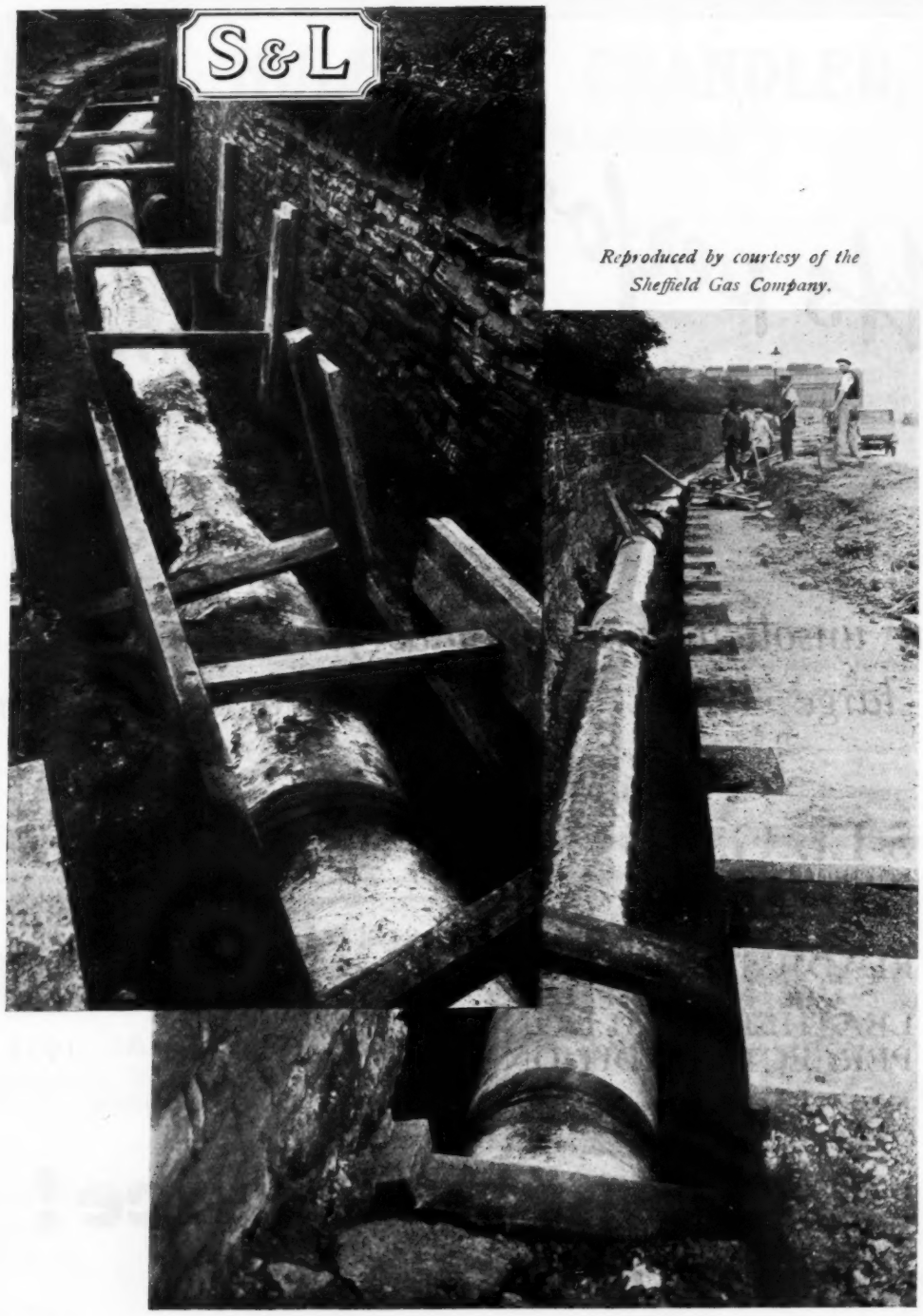

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24-in. Steel Gas Main with Stewarts Spherical Welded Joint. The above illustration shows pipes with these joints laid round curves without the use of bends, and without in any way impairing the efficiency ot the joints.

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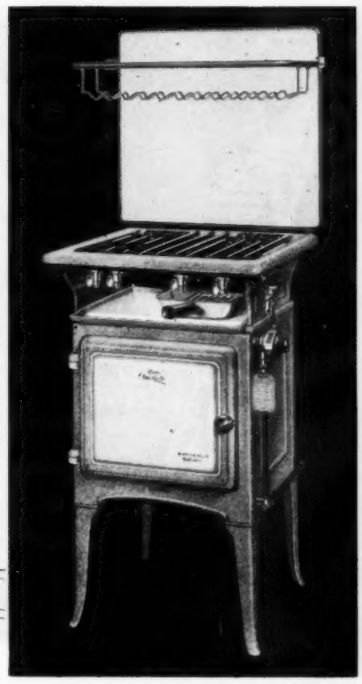

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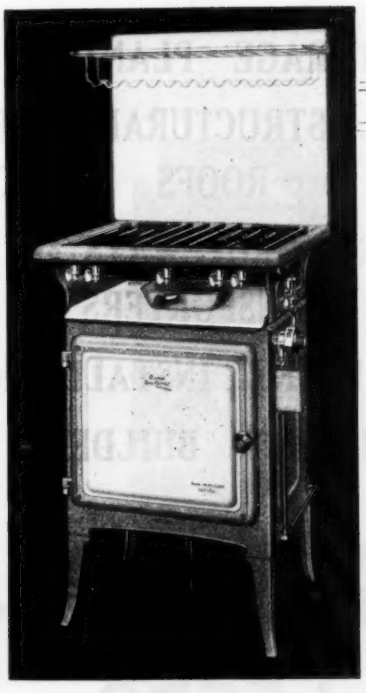

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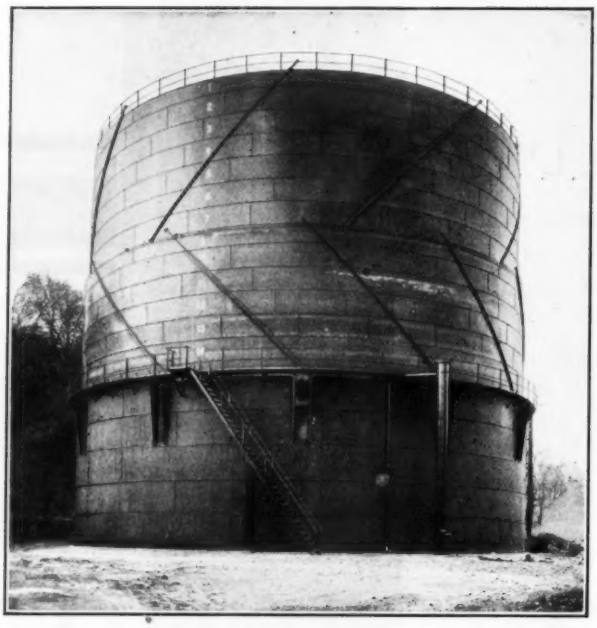

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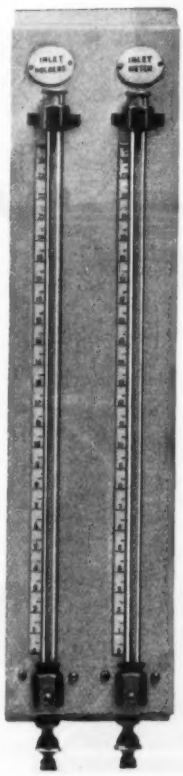

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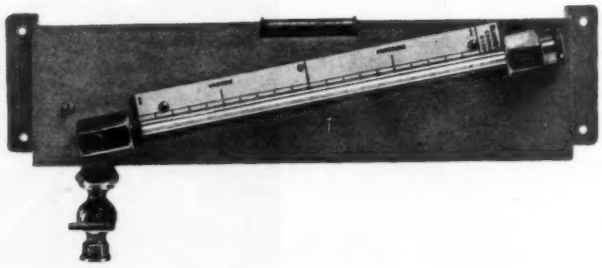

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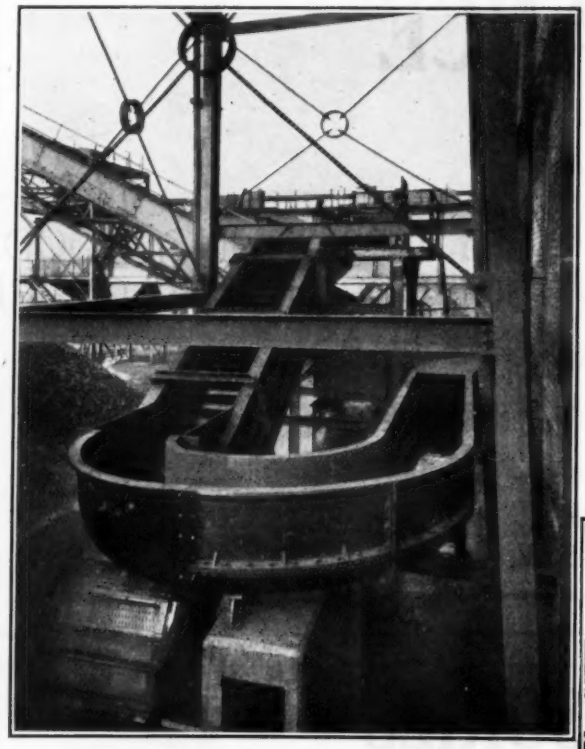

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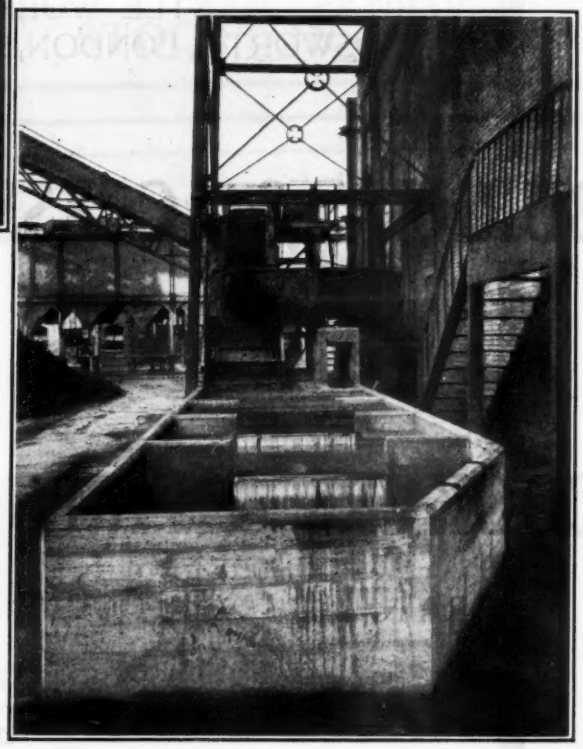

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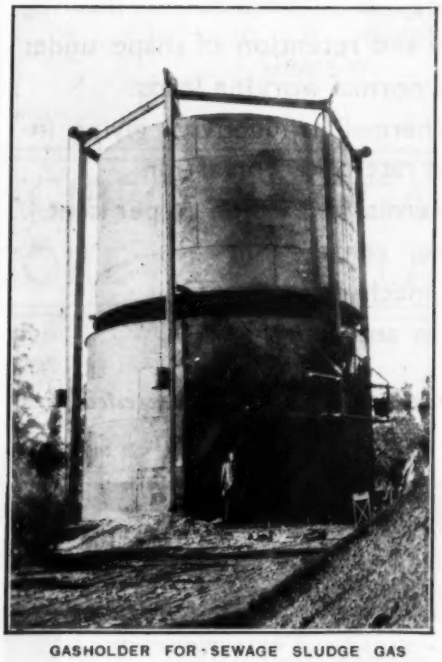

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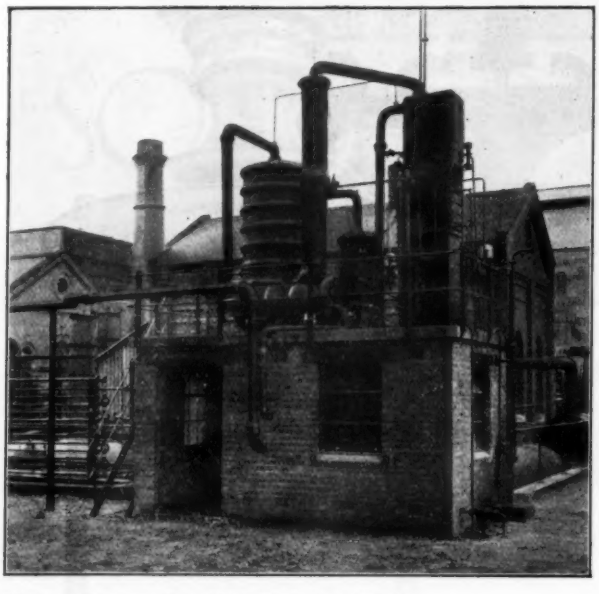

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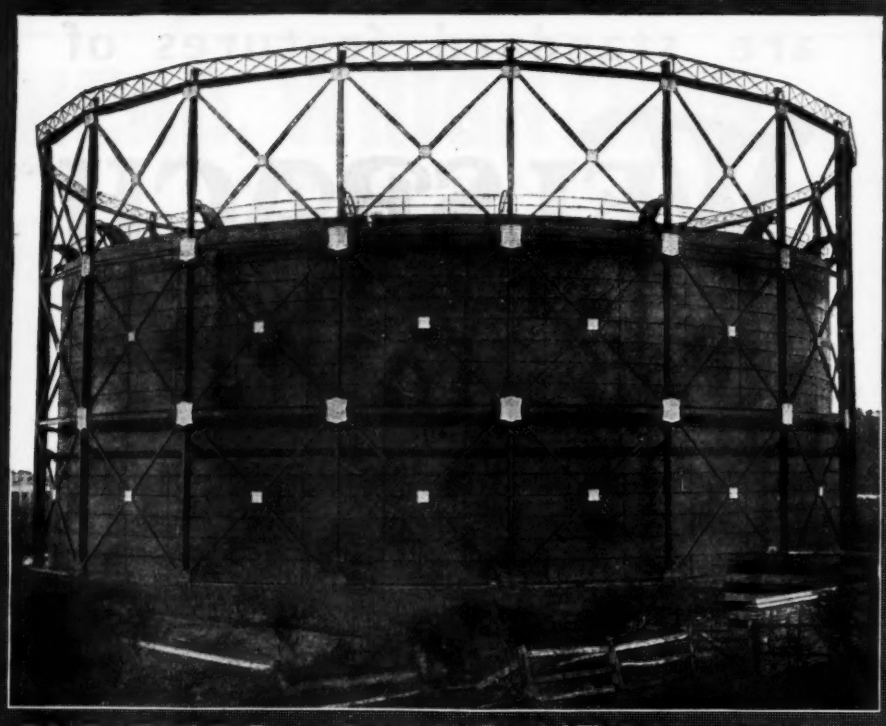

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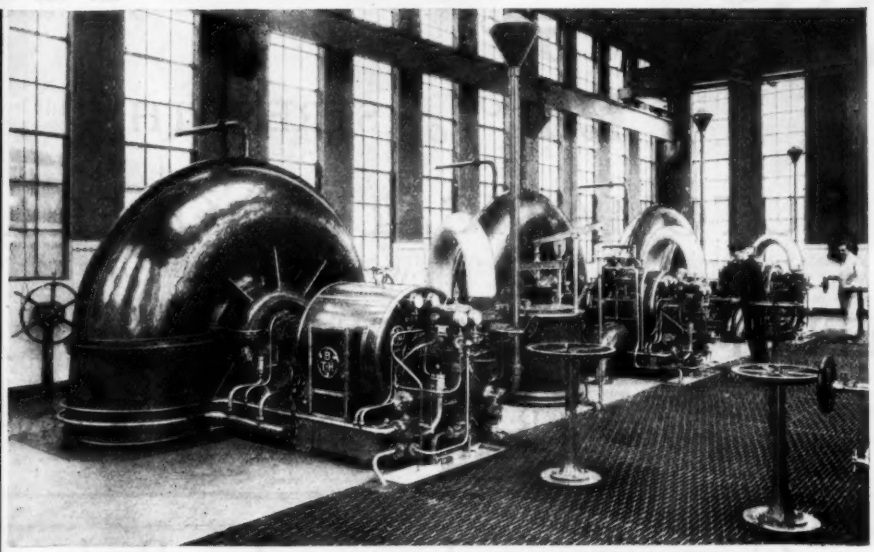

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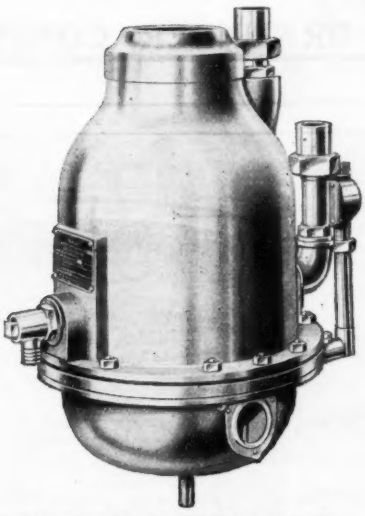

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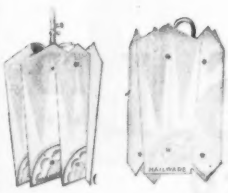

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82

51 WATERLESS (KLONNE) GASHOLDERS

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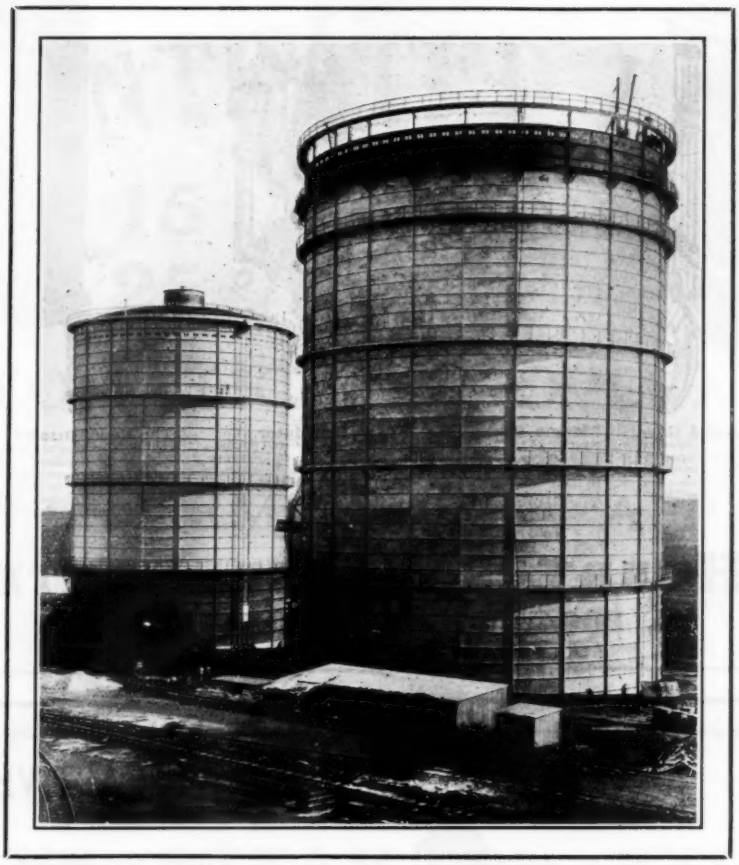

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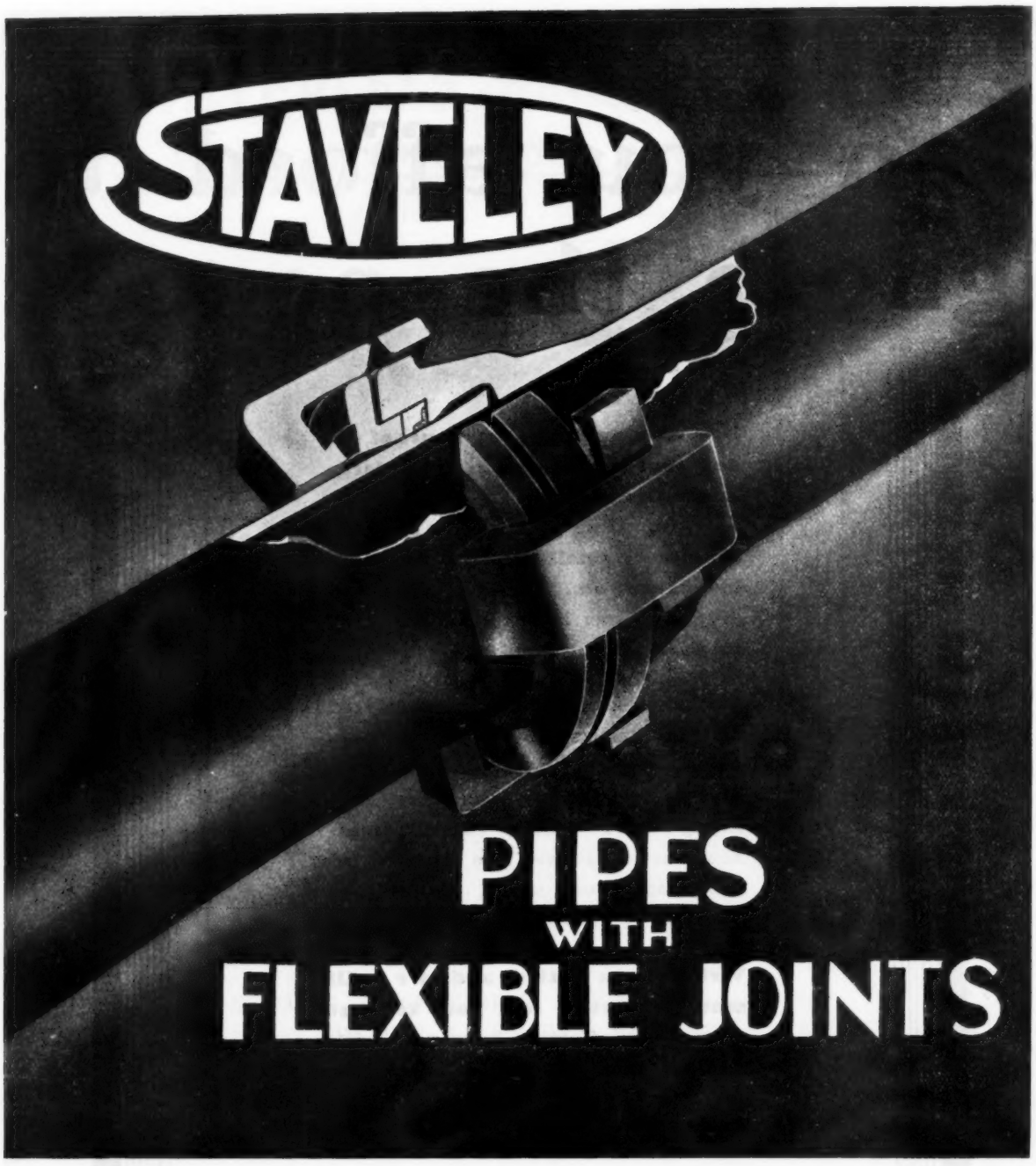
Write us a letter and we will send a meter for you to test yourselves. Test it how you will, and on your results we rest our case.

Geo. Wilson Gas Meters, Ltd.

Coventry, London & Manchester



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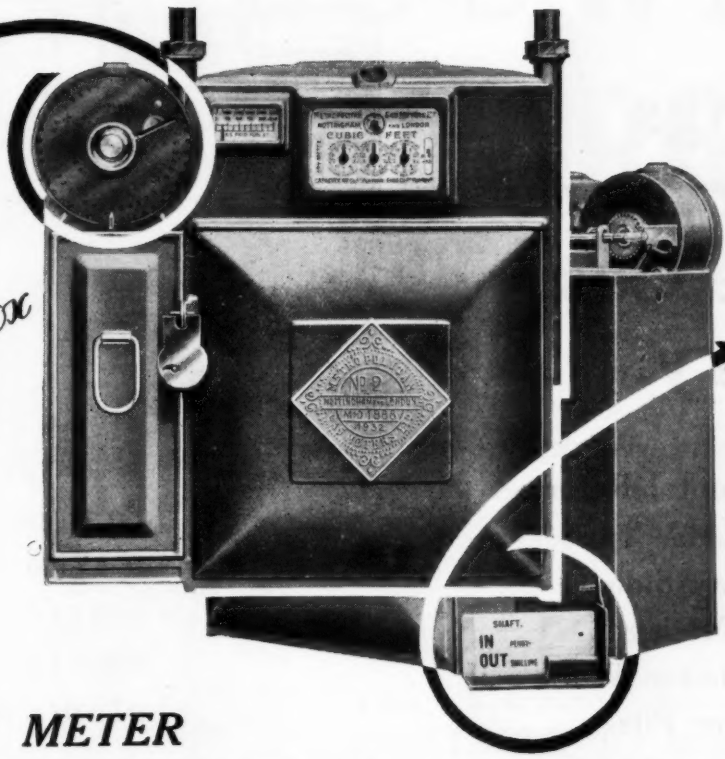

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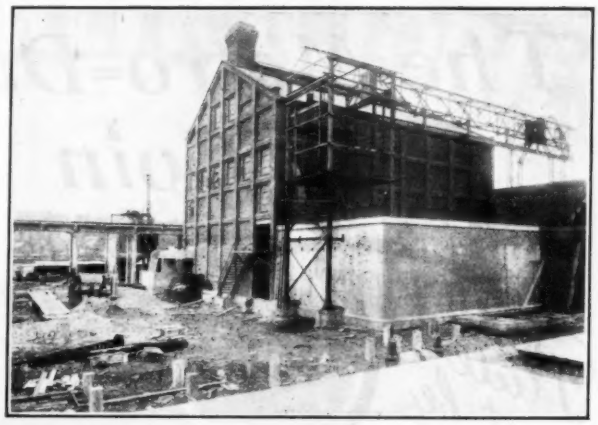

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Retort Houses
Coal Stores
Gantries
Water Towers
Purifier Houses
Chimneys
Retaining Walls
Reservoirs

We specialise in construction and welcome your inquiries at any time for any of the plant mentioned.

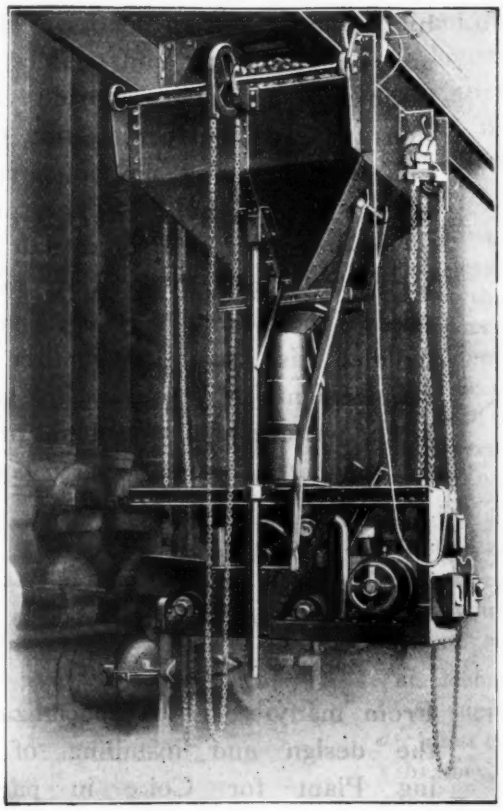
THOS VALE & SONS, LTD.

ESTD. 1869.

STOURPORT, WORCS.

REINFORCED CONCRETE STRUCTURES

THE DE BROUWER CHARGER FOR STOP ENDS.



Improved Efficiency for the Small and Medium Sized Works.

This Machine was designed SPECIALLY for Stop End or Short "Through" Retorts.

It pays for itself very rapidly because of the increased make per ton obtainable through the quick charging. This means more throughput per bed and less wear and tear throughout.

10 SECONDS is the time taken to charge a 10 ft. Retort, and it is a much better charge.

Other manufactures include
Intermittent Vertical Chamber Ovens
Wagon Tippers
Skip Hoists
Coke Screening Plants
Coal Handling Plants
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Steel-frame Buildings
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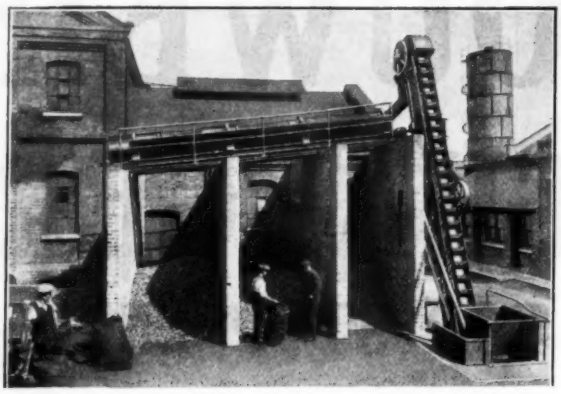
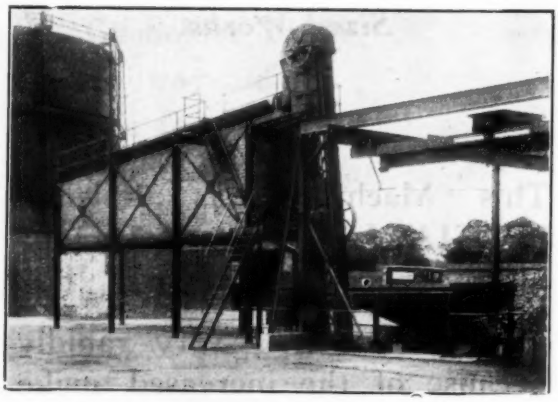
W. J. JENKINS & Co. LTD.
RETFORD, NOTTS.

TELEPHONE Nos. : 131 & 132 RETFORD (*Private Branch Ex.*) *TELEGRAMS* : "JENKINS, RETFORD"
LONDON OFFICE : 17, VICTORIA STREET, S.W.1 *TELEPHONE No.* : VICTORIA 5981

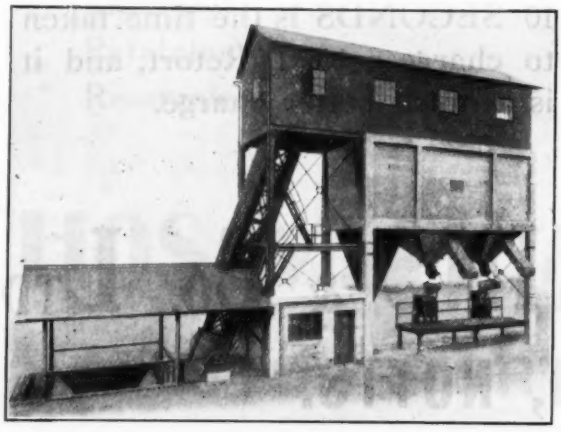
PROFIT FROM



BEXHILL
Capacity 4 to 5 Tons per Hour.



SOLIHULL
Capacity 5 Tons per Hour.



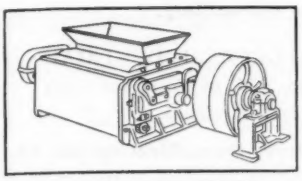
HAMPTON COURT
Capacity 10 to 12 Tons per Hour.

THE question of your making profit or loss from Coke is definitely settled in favour of the former by the installing of modern Handling and Grading Plant and enables Undertakings to counteract outside competition and give that preparation to coke for distribution as now demanded by a ***coke-minded public.*** The purchase of up-to-date Plant does not necessarily mean a heavy outlay, and certainly the capital charge per ton handled is small; whether your requirements or resources are small or large, we are able to submit proposals to adequately cover every condition.

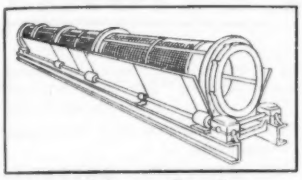
From many years of specialization in the design and installing of Grading Plant for Coke in particular, together with the close co-operation with Engineers of Gas and Coke Undertakings—who have treated the subject seriously—we have gained a unique experience which places us in a position to handle your problems in advance of competition at strictly competitive costs.

ROBT. CORT & SON, LTD
READING BRIDGE IRONWORKS
READING *'Phone: 1002*

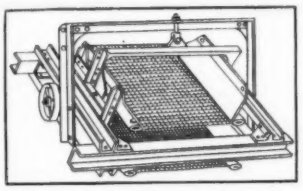
COKE ASSURED



Patent Coke Cutting Machine.
2-100 tons per hour.



Improved Rotary Type Screen.
24 in. to 72 in. Diameter.



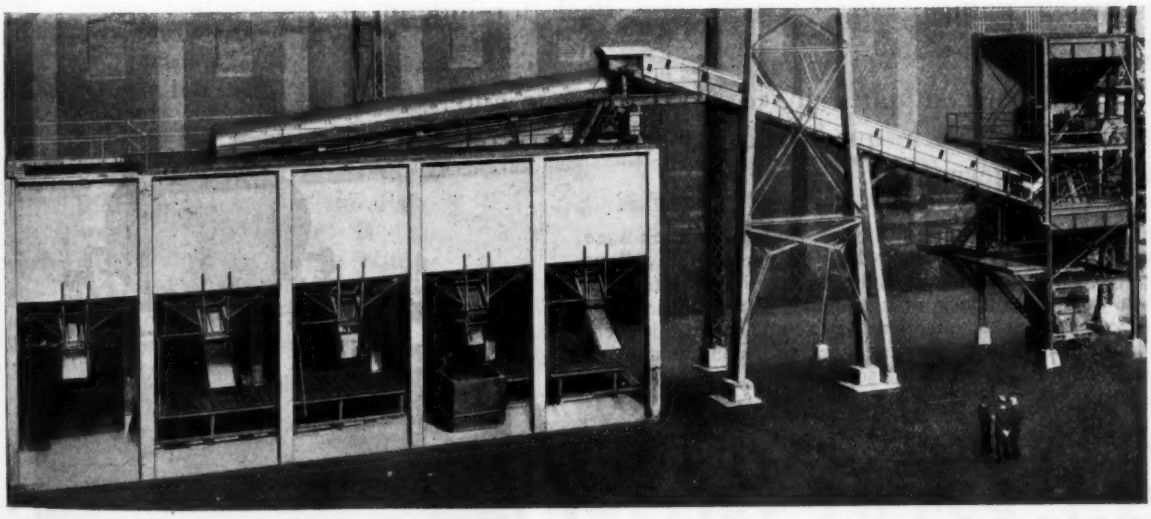
Patent Roto-Vibratory Screen.
Efficient, Silent and Smooth Running.

IN the beginning of our connection with the subject we introduced the COKE CUTTING MACHINE—still pre-eminent for the sizing of coke—capable of producing that squaring or cubing of the product so desirable—unobtainable to the same extent by any other machine—and making the minimum of "fines" by the operation.

On the subject of SCREENS we are able to offer many types, each best of their respective kinds. We are of the opinion that of the several types available one would fulfil a certain requirement better than another, when installed in their appointed place. The Rotary type, designed, built and run in accordance with our practice; or our Roto Vibratory type with an efficiency of approximately 100% with negligible upkeep cost; or our Improved Balanced Reciprocating Screen (or as a screening Conveyor).

We shall be pleased to make offers for the separate units as referred to above equally as for a complete plant, and solicit your enquiries.

The accompanying illustrations show a few examples of Plant supplied by us—incorporated in that shown below is our latest type Coke Cutting Machine, I.R. Band Conveyor, Vibratory, Rotary and Reciprocating De-breezing Types of Screens.



Coke Cutting, Screening, and Storage Plant, Hilsea Gasworks, Portsmouth. Capacity 20 Tons per Hour.

Clean Your Services by

SUCTION!

AND

End all your Stoppage troubles

Don't blow it back into the Mains
Don't open up Roadways unnecessarily

"ABBIRKO" Patent Suction Service Cleanser
Adopted by over 200 Gas Undertakings

Full particulars from Sole Makers:—

ABBOTT BIRKS & Co., 113, NEWINGTON CAUSEWAY, LONDON, S.E.1.

AMAL CALIBRATED GAS NIPPLES

- **are made for any desired flow**
- **± 2% accuracy of flow**
- **True in flow direction.**

STREET LIGHTING DEPTS., INDUSTRIAL FURNACE MAKERS will be furnished with full particulars on request.

AMAL LTD., Ref. G.J., Perry Barr, Birmingham, 20.

FOR JOINTING AND WASHING

VERTICAL RETORTS

Drykos was specially manufactured to meet demands for a Fire Cement in Powder form and is stocked in several Grades; "Standard" is recommended for Fireclay Retorts and "H3" for Silica Retorts and Bricks. For retort and furnace repairs, Drykos invariably gives satisfaction. Send for full particulars to Sole Manufacturers—

PURIMACHOS LTD., ST. PHILIP'S, BRISTOL.

Specify Drykos FIRE CEMENT

VALOR
Storage Equipment *for* Lubricating Oils

THREE 150-gallon tanks fitted with adjustable self-measuring pumps, barrel cradle and dash for indoor storage.

These can also be supplied in 50, 100, 200, 250 and 300 gallon sizes fitted with quart pumps, semi-rotary or gear oil pumps as alternatives.

We are manufacturers of all types of outdoor Storage Equipment, comprising a Sliding-door Cabinet of 55 gallons capacity, barrel covers, drum shelters, portable outfits, etc., fitted with pumps as above or customers' own pumps where desired. We are in a position to give prompt delivery of standard models and are prepared to quote customers' own design and finish where desired.

Write to-day for List 39/V53 and prices

THE VALOR CO., LTD.,

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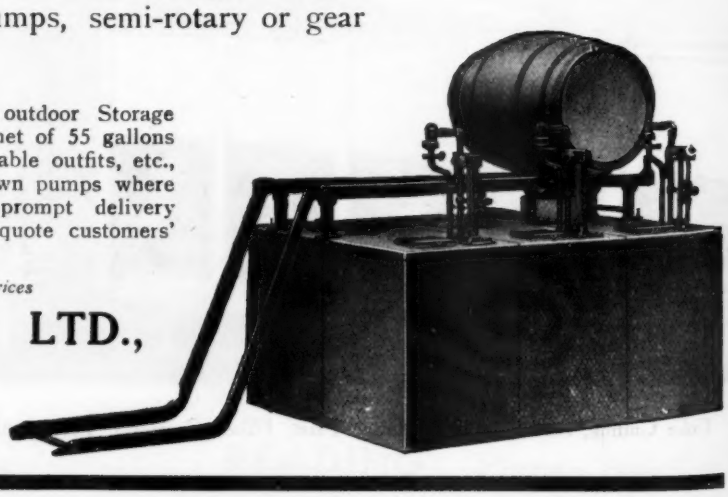
LONDON: 120, Victoria Street, S.W.1.



L.I.

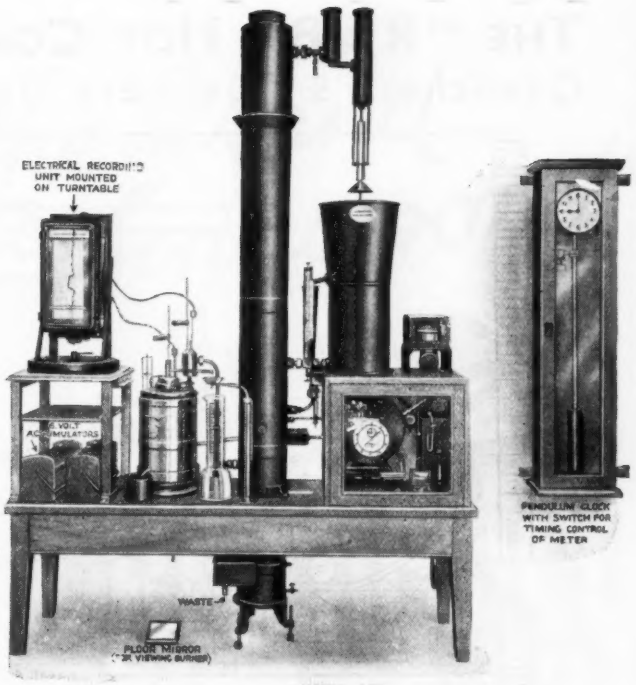
THE LIVERPOOL GAS COMPANY have a similar instrument working at Garston

and

Another is about to be installed at Linacre. Both for official testings.

Other recent orders for these instruments include:-

3 For the Glasgow Corporation Gas Department.	Official Testings
2 For South Metropolitan Gas Co.	
2 For Tottenham & District Gas Co.	
1 For Commercial Gas Co.	
1 For Bristol Gas Co.	
1 For The Gas Light & Coke Co.	
9 For South Metropolitan Gas Co. (East Greenwich Control Room.)	
2 For Sheffield Gas Grid Scheme.	


ELECTRICAL RECORDING UNIT MOUNTED ON TURNTABLE
6 VOLT ACCUMULATORS
WASTE
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PENDULUM CLOCK WITH SWITCH FOR TIMING CONTROL OF METER

FAIRWEATHER RECORDING CALORIMETER

In general use for both Official Testings & Works Control purposes.

Consider the four functioning parts of the Recorder :

1. Tabular Control.

In all essentials the same as at conception over 10 years ago. Unfailingly reliable and trouble free.

2. Water Measurement.

The best method yet devised for continuous measurement of clean water.

Flow automatically varied to suit standard gas volume conditions. 60° F. and 30 ins. mercury.

3. Gas Measurement.

Meter positively controlled at a constant rotation by our patented electrical device. Error in meter rate is nil.

Capacity of meter set and maintained within $\frac{1}{10}$ of one per cent. of accuracy.

4. B.Th.U. Record.

Now more accurate and reliable than ever by the introduction of a patented electrical recording equipment (using long life, 6-Volt accumulators) which has been *approved by the Gas Referees.*

Assures a continuous record within a guaranteed maximum limit of error of 2 B.Th.U.

The accuracy of all these functioning parts are readily checked by the facilities provided in the instrument.

The continuous record is more reliable, less costly, and far more valuable for *all* purposes than ordinary spot testings.

Consideration of these facts makes it clear that the Fairweather Recorder is an essential unit in the equipment of every Gas Undertaking—large or small.

Also available : DISTANCE RECORDER AND INDICATOR.
COMPLETE WATER CIRCULATING SYSTEM.

SCIENTIFIC & PROJECTIONS LTD.

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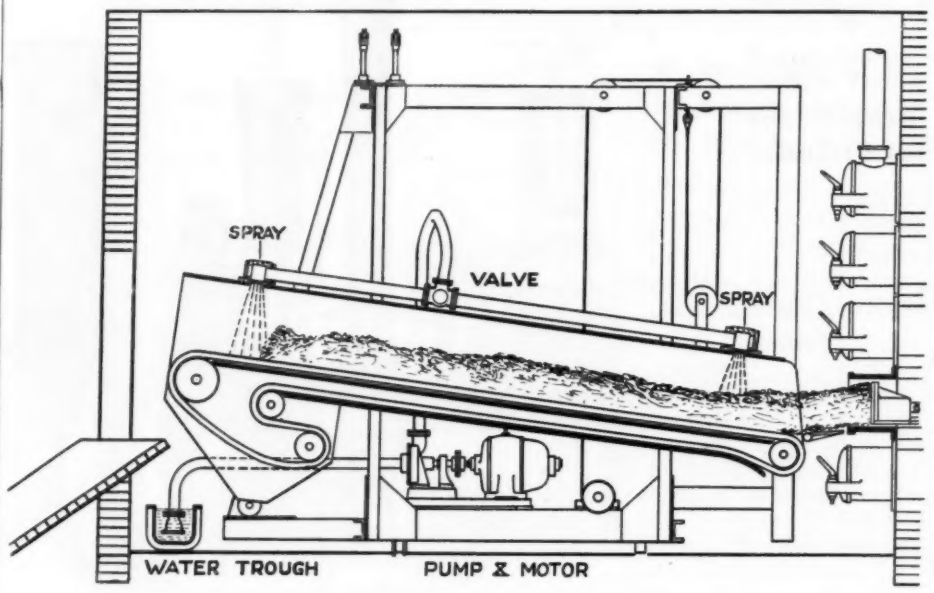
THE "R & B" HOT COKE MACHINE (PATENTED)

Quenches & Delivers in the Quickest Way



THERE IS NOW NO NEED TO PRODUCE POOR COKE

Machines may be seen at work

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'Grams: Ridbel Retford

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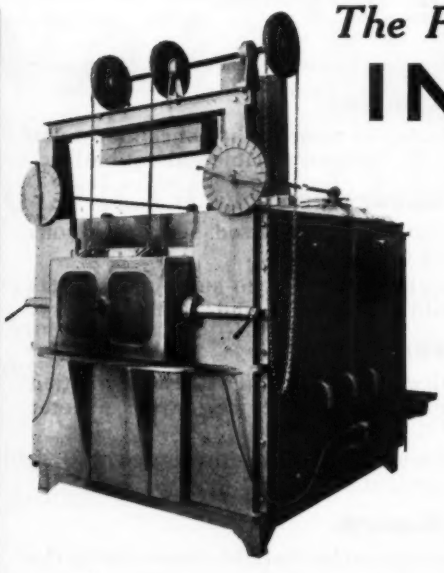

The Patent

INCANDESCENT

"SUPER" FURNACE

UNUSUALLY SUCCESSFUL RESULTS

have been obtained in actual practice by the patent Incandescent "Super" Gas-fired Furnace over a wide range of applications. This type of furnace has been installed for such work as carburising, reheating, tempering, normalising, annealing, and hardening; in every case more advantageous figures of consumption and maintenance have been obtained than with any other type of furnace.

In several instances where critical temperature control has been necessary and where variations of more than a very few degrees over the entire area of a furnace would result in the absolute scrap of the whole charge, the patent Incandescent "Super" Furnace has been installed with absolute success.

This furnace has been installed for special process work where temperature ranges varying from 200 to 1400 degrees Centigrade must necessarily be maintained over long periods within critical limits. In these cases only natural draught potential has been used and the furnace automatically controlled by the patent

INCANDESCENT "AUTOTROLLER" CONTROLLER

which ensures automatic regulation of gas, secondary air supply, and damper adjustment to suit temperature variations, and in a pre-determined proportion to maintain a given atmosphere in the chamber.

Write for complete Specification and Prices to—

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0875/6/7 (3 lines) SMETHWICK
Telegrams:
"REPEAT," BIRMINGHAM

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"INCANDHEAT, KNIGHTS," London

From the Strand to Singapore!

NORFOLK STREET, STRAND, LONDON, looking toward Australia House. The upright "Rochester" lamps shown are among the first of a very large number to be installed under the big contract from the City of Westminster, obtained by the Gas Light and Coke Company.

SUGG'S Rochester LAMPS

are providing

MODERN STREET LIGHTING.

The Illustrations show only two examples of lighting by Sugg's famous lamps; they are used in many towns and cities throughout the United Kingdom and the World. The added illumination, provided gratis by the Directional Reflector, is being taken advantage of to an ever increasing extent.

SUGG
WESTMINSTER

The lamp fitted with Sugg's Directional Reflector which increases Candle Power enormously.

SINGAPORE,
St. Andrew's Road, lighted by upright "Rochester" lamps.

Cataloques, Folders, and all information from

William SUGG & Co. Ltd

Ranelagh Works, Chapter Street,
WESTMINSTER. S.W.1.

The George Glover Gas Meter which takes pennies and shillings
This meter can, in addition, be easily restricted to take pennies only or shillings only.
Ring up Sloane 7257 or write to Ranelagh Works, Royal Avenue, Chelsea, London, S.W.3.
Chelsea
GEORGE GLOVER & CO. LTD
RANELAGH WORKS ROYAL AVENUE CHELSEA

NEWBRIDGE

MODERN GAS APPLIANCES

TYPE 3A/UNI Gas Controller.
15 or 40/42 day run.

The finest controller extant for use in ordinary "square" lanterns. Now available, as an alternative, with improved form of electro catalytic ignition.

Public lighting Controllers

We are proud of the fact that Newbridge controllers enjoy the *Largest Sale in the World* but we are prouder of the quality and value embodied in these productions which are responsible for their commercial success.

A full range of models is available for all purposes.

All Newbridge Gas Appliances are of the highest quality throughout, embodying sound but distinctive engineering practice.

The continued expansion of our business is proof of the esteem in which Newbridge Controllers, Gas Switches, Governors and other products are held by members of the Gas Industry.

It is our constant aim to *Improve the Product* by a rigid attention to excellence of quality and systematic research and invention.

Gas Switches

Newbridge Gas Switches are being installed in increasing quantities by progressive Gas Engineers who realise that their consumers demand convenience equal to that provided by electricity.

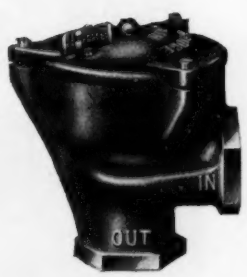
Gas for domestic lighting purposes is by no means a "dead letter" since the advent of Newbridge Switches.

Newbridge Gas Fire Switches (with improved electro-catalytic ignition) are ideal for gas fire control. They eliminate matches, noisy ignition and stooping.

Pressure Governors

Newbridge Pressure Governors embody many unique features in design which render them the safest and most reliable it is possible to obtain.

The neutral valve provides uniform outlet pressure irrespective of inlet pressure, whilst an oil immersed piston takes the place of a leather diaphragm or mercury seal.



Particulars and samples of the above products sent upon application.

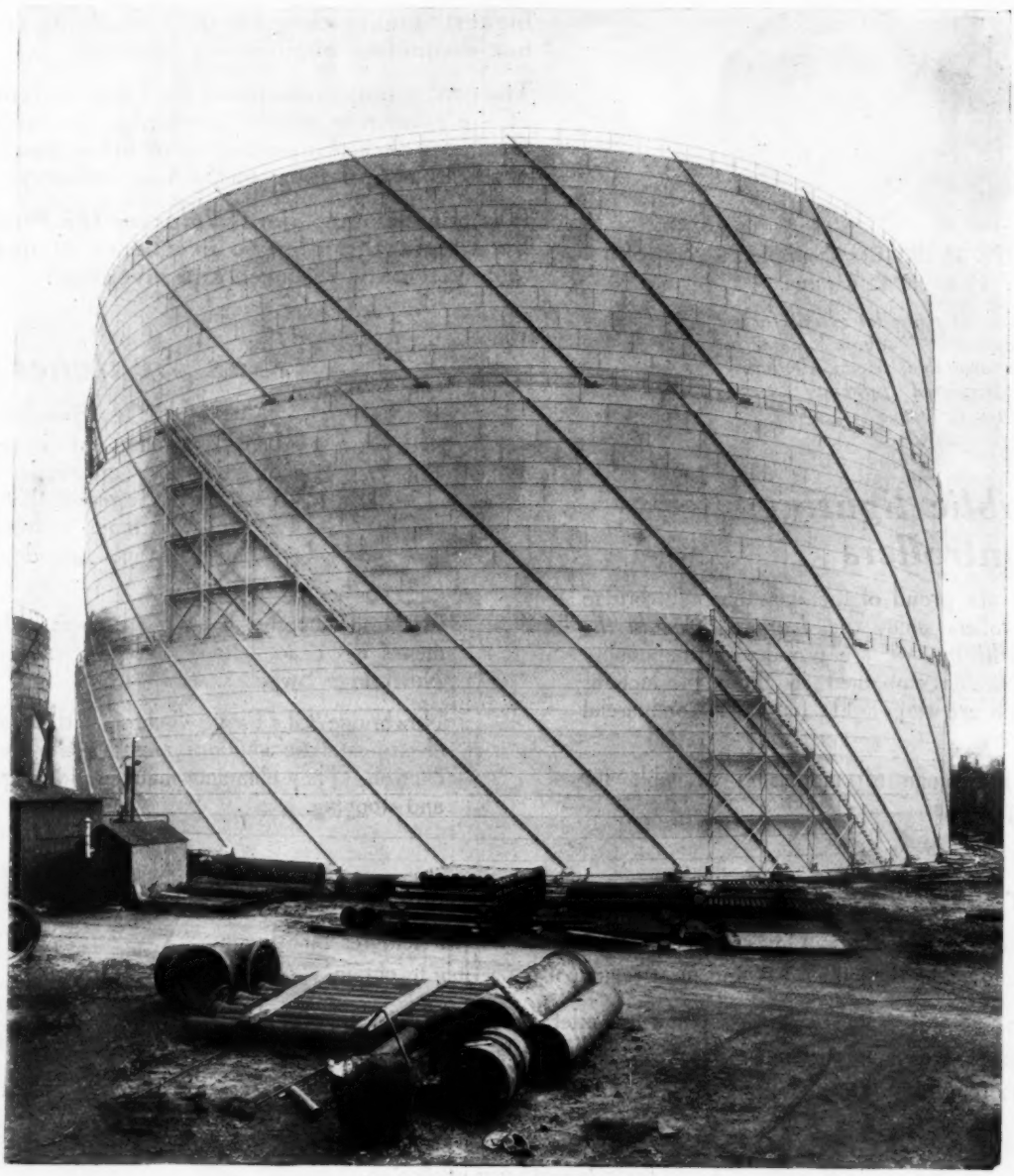
The HORSTMANN GEAR Co., Ltd.

NEWBRIDGE WORKS, BATH

Telephone : Weston, Bath 7241/2. **Telegrams : Horstmann, Bath**

GASHOLDERS

Spiral and Guide Framed—Repairs and Extensions a Speciality.



3-LIFT SPIRAL GUIDED GASHOLDER 201' 0" DIA.
BUILT IN EXISTING BRICK TANK FOR
THE GAS LIGHT & COKE CO., BETHNAL GREEN STATION.
CAPACITY 3¼ MILLION CUBIC FEET.

WESTWOOD & WRIGHTS, LTD.

BRIERLEY HILL - STAFFS.

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Kleenoff
REGISTERED
cleans cookers

WITHOUT RUBBING OR SCRUBBING

You can't rub the back & corners of your cooker clean—You need **KLEENOFF**

The test of a good cleaner is not cleaning a patch on an oven door. Try it on the top inside and back of oven and in the corners. Kleenoff will remove the hard baked-on grease from all parts of the oven without rubbing! Kleenoff is non-abrasive and completely odourless, therefore, it cleans without harming fine enamel surfaces and leaves the oven sweet and fresh.

Consistently and Extensively advertised

10D.

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Supplied in ½-cwt. Drums and 14-lb. tins extra strong for use in Stove Shops.

NOTE THE NUMBER OF CONSUMERS THAT ASK FOR KLEENOFF

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(PROPRIETORS: BALE & CHURCH, LTD.)

ESTABLISHED 1834.

HARPER & MOORES FIREBRICK Co., LTD.,

Telephone Lye 23. STOURBRIDGE Telegrams "Moores, Lye."

RETORTS

Manufactured of Highly Siliceous Material containing **81·6%** Silica

After Contraction or Expansion at 1400°C.—**NIL**

This material is specially adapted for SECTIONAL RETORTS

"TULLY" GAS

THE IDEAL GAS SUITED TO ALL MODERN NEEDS

ECONOMICAL IN USE AND CHEAP TO PRODUCE

THERE ARE SEVERAL HUNDRED "TULLY" PLANTS IN USE AND NUMEROUS GAS WORKS ARE SENDING OUT ALL "TULLY" GAS

Sole Makers and Patentees:

TULLY, SONS & Co., LTD.
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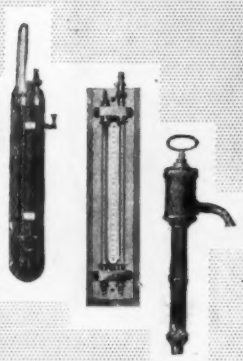
METERS

PRESSURE GAUGES

SYPHON PUMPS



WET & DRY GAS METERS
Standard and High Capacity Meters

Station Meters, Pressure Gauges, Syphon Pumps

SLOT METERS
Simple, Strong, Compact, Accurate
1d. or **1s.** or **Two-Coin**

Sole Agents in Scotland for "RENRUT" SERVICE CLEANSERS
Telegrams: "DAGRAN" Telephone No.: 41574

DAVID GRANT & CO.
East Crosscauseway,
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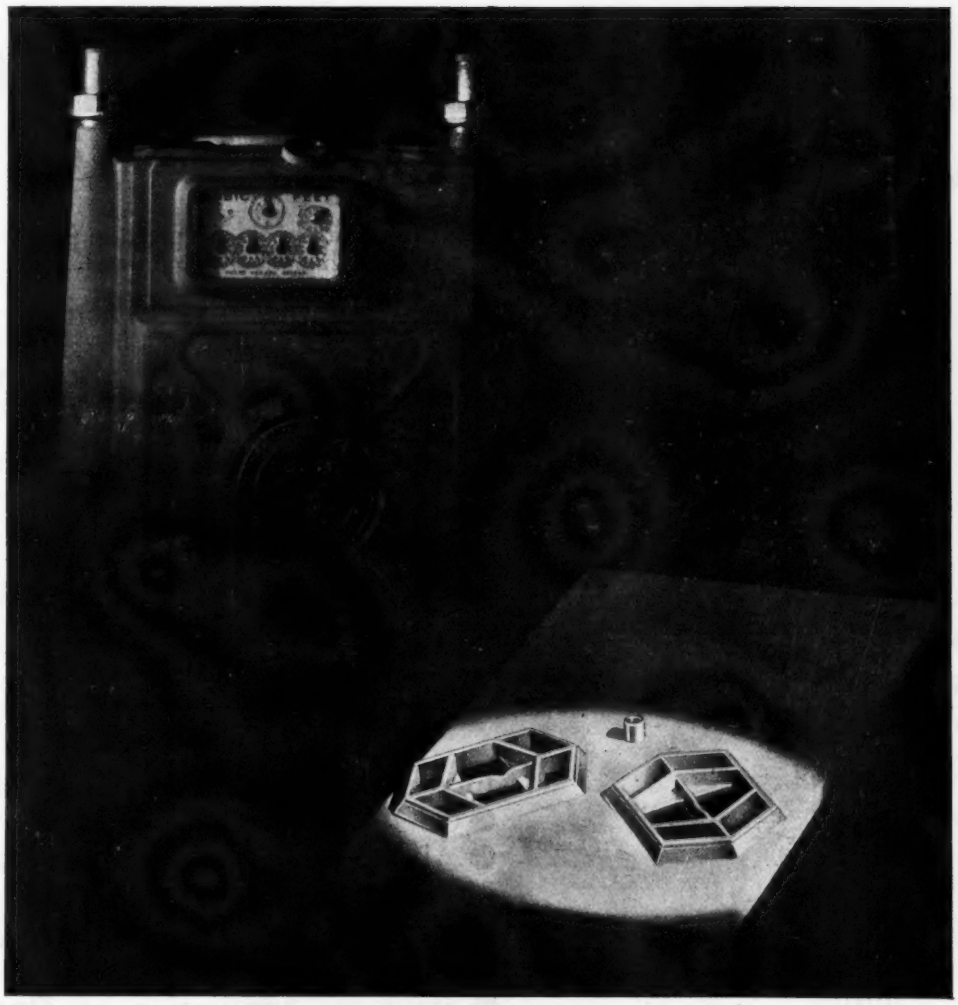

THE VALVE—WHICH INAUGURATED A NEW ERA IN GAS MEASUREMENT AND IS STILL THE BEST.

Made only by ROBINSONS and used exclusively in their **"FLEXIBLE OUTPUT" METER.**

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LIVERPOOL.

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for

Imperial and Local Taxation

By H. T. SEYMOUR, A.C.I.S., A.L.A.A.,

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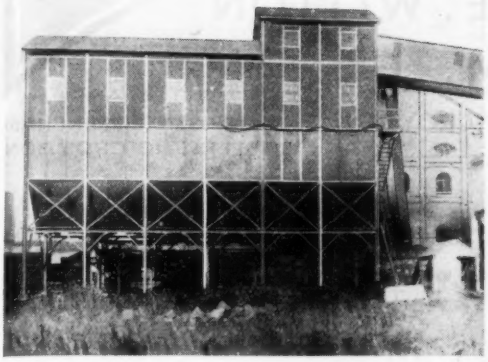
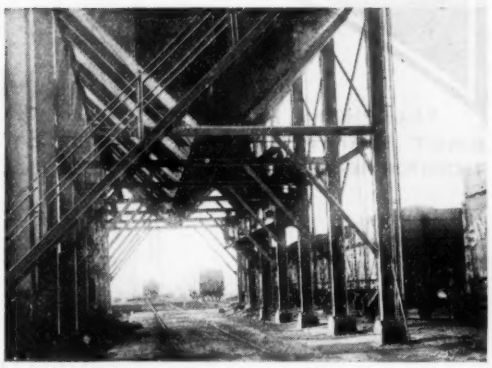
A MODERN COKE SCREENING AND GRADING PLANT

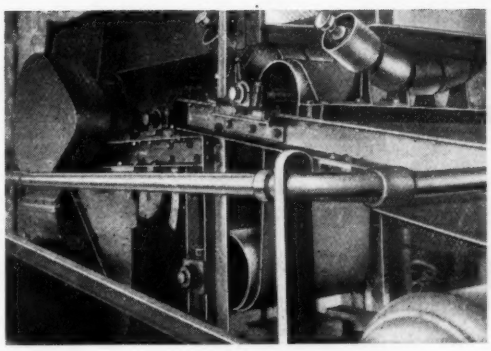


THIS IS ONE OF OUR LATEST PLANTS FITTED WITH MODERN AND UP-TO-DATE UNITS THROUGHOUT



All-Electric Vibrating Grading Screens
TOTALLY ENCLOSED FOR DUST PROTECTION

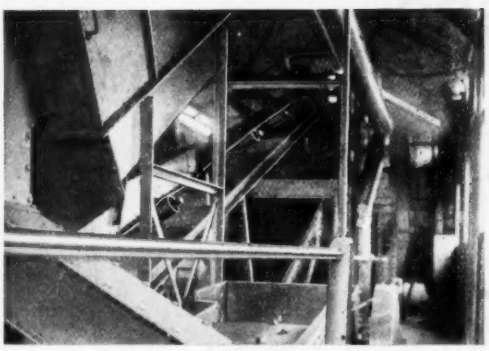
Washing Plant for Producing Clean Washed Coke



Dust-Collecting and Removing Plant.

COKE ANTI-BREAKAGE SHOOTS THROUGHOUT

ADJUSTABLE COKE-CUTTER.



ROLLER BEARINGS ON ALL BELT CONVEYOR IDLERS

SELF-OILING BEARINGS THROUGHOUT (DUST-PROOF)

The New Conveyor Co., Ltd., Smethwick

Telephone: 0801 SMETHWICK — Near Birmingham — Telegrams: "APTITUDE, BIRMINGHAM."

Designs of similar plants to suit your works will be submitted to you free.

Send us a Postcard and we will send an Engineer at once.

THE SUTHERLAND METER Co. Ltd.

ELECTRIC AVENUE, WITTON
BIRMINGHAM, 6.

TELEPHONE
EAST 1291 - 1292
THORNTON HEATH 1331

AND 147 ST. JAMES ROAD, CROYDON.

TELEGRAMS
METERISTIC, BIRMINGHAM.
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Manufacturers of

ORDINARY METERS

PREPAYMENT METERS

GAS FIRE METERS

CLOCKWORK LIGHTERS

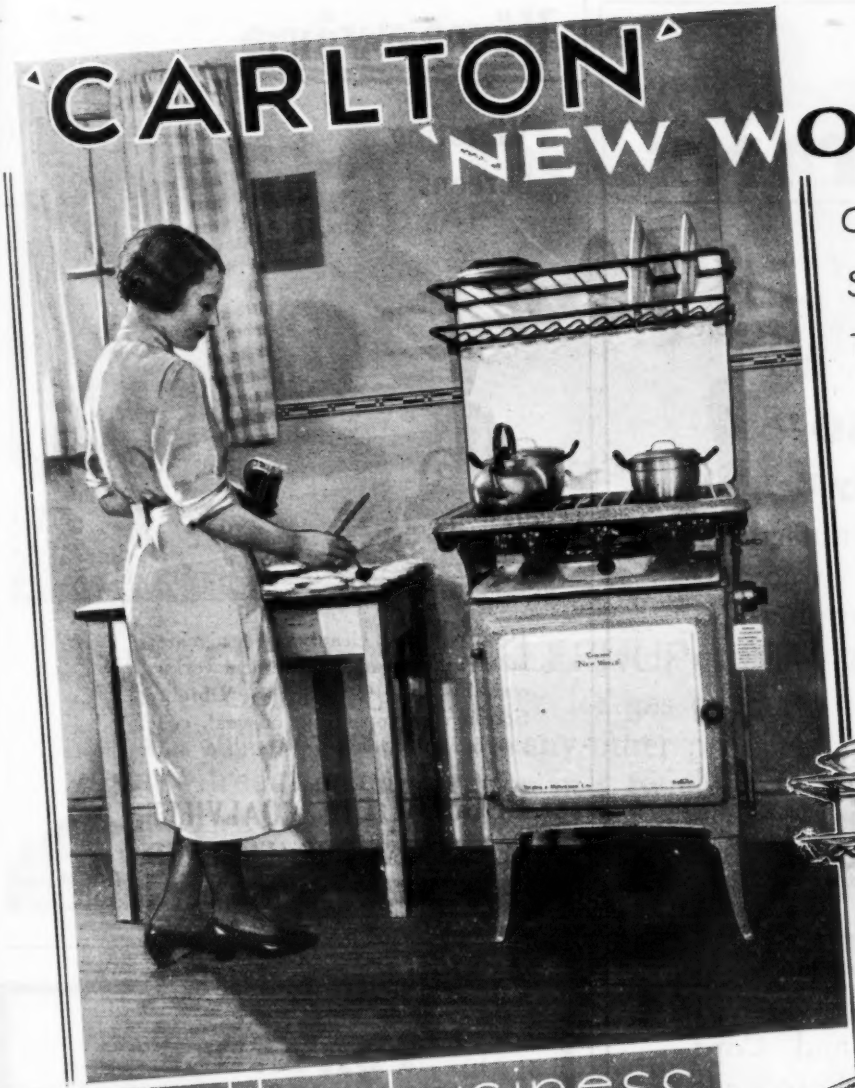
TEST METERS

TEST HOLDERS

GAS WORKS PLANT

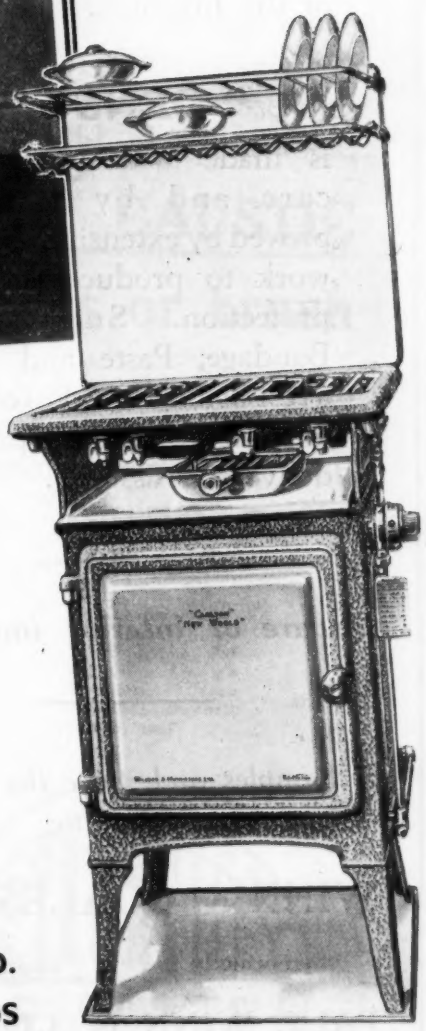
'CARLTON' 'NEW WORLD'

Cookers—
Series
Two



for better business

"STILL better and better still" is the Wilson motto and the new series of the "Carlton" "New World" Cookers is bringing compliments by the score. The Wilson individuality of workmanship is seen to advantage and with the standard "New World" features of "Regulo" automatic oven-heat control, single oven burner and direct bottom-flue-outlet, makes this series a sales-bringer that meets every possible modern requirement. The new Wilson illustrated price list is now available and may be obtained on application.



WILSONS & MATHIESONS LTD.

CARLTON WORKS——ARMLEY, LEEDS

(*Radiation Ltd., Proprietors.*)

IMPORTANT

We are pleased to be able to announce that

" DENSO "

is now entirely British

and is being manufactured by us in London in accordance with the formula and manufacturing specification of the Inventor.

" DENSO "

is made with meticulous care and by methods proved by extensive research work to produce the best protection. Supplies of Bandage, Paste and Cord are available at lowest possible prices and prompt delivery is assured.

Beware of inferior imitations.

Samples and price list upon request to

WINN & COALES LTD.

Formerly the " C " Dept. of

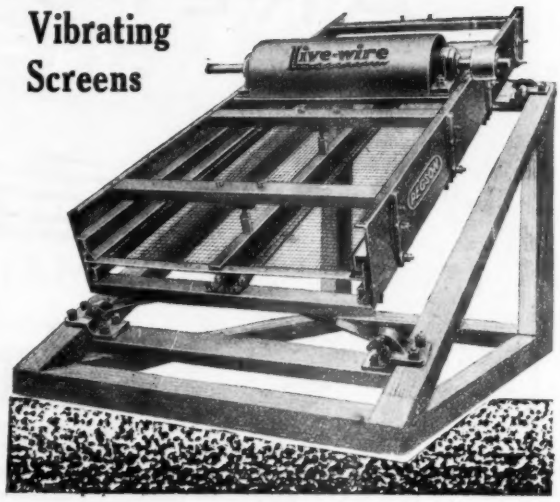
PAUL WINN & CO., LTD.

" Tower House," 40, Trinity Square

LONDON, E.C. 3.

Live-wire

Vibrating Screens



High outputs of cleanly screened material are attained at an economical working cost by the " Live-wire " Vibrating Screen when operating on coal, coke, slag or ashes. *Only* 1 B.H.P. *to drive.*

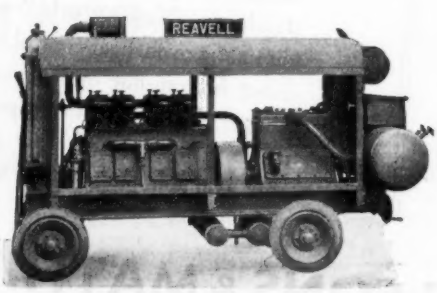
PEGSON LTD., COALVILLE, LEICESTERSHIRE, ENGLAND.

BRITISH BUILT

PORTABLE COMPRESSORS.

* * *

We build a complete range of Petrol, Paraffin, and Diesel Engine driven Portable Air Compressors, suitable for breaking up roadways with Pneumatic Picks, for laying Gas Mains, and for caulking and testing Pipe Lines.



For particulars and pamphlets write to :—

REAVELL & CO., LTD.,

RANELAGH WORKS, IPSWICH.

Telegrams : Reavell, Ipswich. Telephone 2124 & 5.

"KLEENUP" beats the lot!

It is a FACT that "KLEENUP"—the absolutely NON-SCRATCH wonder cleaner for gas cookers—does its job more quickly and effectively than any other product on the market. It cleans vitreous enamel or iron in a twinkling. Removes grease like magic. Leaves a gas-cooker looking as **you** would wish it to look.

"KLEENUP" CONTAINS NO CAUSTIC

It can be used without gloves or brush

That's another big advantage. Nothing in "Kleenup" to harm the hands. No need for housewives to wear gloves when they use it. Let housewives see "Kleenup" in your showrooms. Tell them what it does. **Show** them what it does. "Kleenup" is good propaganda for gas cookers.

IMPORTANT

Why damage the cooker packing by continued use of caustic and water, which creates condensation and consequent smells? It is impossible for this to occur with "KLEENUP," which is a dry-cleaning paste.
Write us for generous FREE sample and prove "KLEENUP" for yourself. What you say goes.

Manufactured by:
ASTRAH PRODUCTS, ST. HELENS, LANCS.
Head Office:
7, HIGH STREET, SUTTON, SURREY.
Telephone: Sutton 5127.

In tins for household use at 6d. In 7 lb. drums for use in large kitchens, Stove Repair Departments, etc.

CLEANS INSTANTLY
KLEENUP
6D
The "Non-Scratch" quick cleaner for greasy Gas Cookers, dull Baths and dirty Enamel and Metal-work. Use a little on a dry cloth. No brush required. No need to wear gloves.
6D
Invaluable to motorists and engineers for removing dirt from the hands.
KLEENUP CONTAINS NO ACID

The good companion of the gas cooker

Humphreys & Glasgow Ltd.
Water-Gas

	Cu. Ft. Daily
Aarhus	800,000
Abertillery	500,000
Abertillery	100,000
Admiralty:	
British	4,000,000
French	1,600,000
Agram	200,000
Airdrie	430,000
Aldershot	1,400,000
Aldershot	1,000,000
Aldershot	1,316,000
Algiers	1,750,000
Alkmaar	400,000
Allenstein	200,000
Alost	700,000
Amersfoort	300,000
Amsterdam	1,000,000
Amsterdam	1,000,000
Amsterdam	2,700,000
Amsterdam	1,350,000
Antwerp	1,500,000
Antwerp	1,000,000
Antwerp	1,500,000
Antwerp	1,900,000
Arundel	215,000
Ascot	423,000
Ashford	250,000
Athens, Greece	550,000
Augsburg	425,000
Aylesbury	150,000
Aylesbury	470,000
Banbury	200,000
Banff	125,000
Barmen	500,000
Barnsley	588,000
Barrow	300,000
Barrow	500,000
Barry	500,000
Barry	720,000
Bath	1,000,000
Bath	1,000,000
Bath	1,300,000
Bath	1,200,000
Bedford	1,000,000
Belfast	1,700,000
Belfast	4,500,000
Belfast	1,250,000
Belfast	1,250,000
Belfast	2,250,000
Benrath	125,000
Berkhampstead	259,000
Berlin:	
Charlottenb'g	2,500,000
Danziger Str.	1,600,000
Neukoelln	1,350,000
Schmargendorf	760,000
Tegel	10,095,000
Berne, Switz.	725,000
Bexhill	400,000
Bideford	258,000
Bilston	375,000
Bilston	125,000
Birmingham:	
Adderley St.	675,000
Adderley St.	850,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	3,000,000
Nechells	7,650,000
Swan Village	1,500,000
Windsor St.	3,000,000
Windsor St.	3,000,000
Windsor St.	6,100,000
Bishop's Stortford	200,000
Bishop's Stortford	300,000
Bishop's Stortford	200,000
Bishop's Stortford	300,000
Blackburn	1,190,000
Blantyre	150,000
Blois	125,000
Blois	125,000
Bochum	530,000
Bognor	423,000
Bognor	500,000
Bo'ness	125,000
Bo'ness	250,000
Boulogne	340 000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,500,000
Bournemouth	1,000,000
Bournemouth	500,000
Bournemouth	1,530,000
Bournemouth	2,000,000
Bournemouth	500,000
Bournemouth	2,750,000
Bradford	1,260,000
Bremen	550,000
Bremen	950,000
Bremen	850,000
Brentwood	250,000
Brescia	588,000
Brescia	588,000
Brest	550,000
Bridgwater	200,000
Bridlington	150,000
Bridlington	200,000
Bridlington	550,000
Brieg	100,000
Brierley Hill	250,000
Brierley Hill	425,000
Brighton	1,750,000
Brighton	1,850,000
Brighton	750,000
Brighton	2,750,000
Brighton	3,000,000
Bristol	2,000,000
Bristol	2,500,000
Bristol	825,000
Bristol	825,000
Bristol	1,500,000
Bromley	1,500,000
Bruges	200,000
Bruges	600,000
Brussels:	
Anderiecht	350,000
Anderiecht	350,000
Forest	1,000,000
Forest	1,000,000
Forest	1,000,000
Forest	1,500,000
Forest	88,000
Koekelberg	1,000,000
St. Gilles	1,000,000
Brussels:	Cu. Ft. Daily
St. Josse	1,000,000
St. Josse	600,000
St. Josse	775,000
Ville	750,000
Ville	750,000
Ville	1,500,000
Ville	350,000
Bucarest	1,100,000
Buckie	164,000
Budapest	50,000
Budapest	1,750,000
Budapest	200,000
Budapest	250,000
Burnley	1,350,000
Caen	250,000
Cambridge	500,000
Cambridge	1,000,000
Cambridge	1,700,000
Cardiff	2,000,000
Cardiff	3,000,000
Cardiff	1,950,000
Carlisle	600,000
Carlsruhe	500,000
Carnarvon	248,000
Charleroi	1,250,000
Chateauroux	125,000
Chateauroux	125,000
Châtelet	500,000
Chester	564,000
Chesterfield	430,000
Chesterfield	90,000
Chesterton	197,000
Chichester	250,000
Chorley	300,000
Cie. de Béthune	2,145,000
Cie. des Compteurs	1,150,000
Cie. Lorraine de Ch.	210,000
Cie. Minesde Roche	585,000
Coatbridge	400,000
Commercial, Ltn	850,000
Commercial	850,000
Commercial	1,250,000
Commercial	2,000,000
Commercial	800,000
Commercial	2,100,000
Copenhagen	700 000
Copenhagen	2,500,000
Copenhagen	1,750,000
Copenhagen	1,200,000
Courtrai	250,000
Coventry	600,000
Coventry	600,000
Coventry	1,000,000
Coventry	1,250,000
Coventry	350,000
Cowdenbeath	420,000
Cracow	400,000
Cranleigh	188,000
Crefeld	500,000
Crewe	700,000
Crewe	800,000
Crosfield & Sons	1,500,000
Crosfield & Sons	1,500,000
Croydon	1,250,000
Croydon	625,000
Croydon	625,000
Croydon	550,000
Croydon	650,000
Croydon	1,125,000
Croydon	150,000
Croydon	6,000,000
Deal	250,000
Deal	250,000
Debreczin	100,000
Derby	1,500,000
Derby	2,000,000
Deventer	150,000
Deventer	500,000
Devonport	1,600,000
Devonport	1,100,000
Doncaster	1,350,000
Dorking	150,000
Dorking	300,000
Dorking	130,000
Dover	500,000
Dover	300,000
Dublin	2,000,000
Dublin	2,000,000
Dublin	650,000
Dudley	600,000
Dundee	1,500,000
Dundee	1,650,000
Dundee	900,000
Dunedin, N.Z.	150,000
Dunedin	275,000
Durham	200,000
Dusseldorf	1,000,000
Eastbourne	1,250,000
Eastbourne	1,550,000
Edinburgh	2,000,000
Edinburgh	2,800,000
Eindhoven	1,500,000
Electro-Chimie	650,000
Enschede	282,000
Epping	500,000
Epsom	225,000
Epsom	300,000
Essen	1,400,000
Essen-Borbeck	1,400,000
Exeter	1,100,000
Exeter	1,200,000
Exmouth	376,000
Falmouth	150,000
Falmouth	200,000
Farnham	300,000
Faversham	200,000
Flensburg	300,000
Flensburg	125,000
Folkestone	1,800,000
Fond. del Pignone	164,000
Forst	300,000
Frankenthal	175,000
Fuel Research Wks.	500,000
Fuel Research Wks.	500,000
Gablonz	140,000
Gas L. & C. Co:	
Beckton	10,000,000
Beckton	7,000,000
Beckton	3,500,000
Beckton	7,000,000
Beckton	7,000,000
Gas L. & C. Co:	Cu. Ft. Daily
Beckton	5,250,000
Beckton	4,500,000
Beckton	3,000,000
Beckton	1,500,000
Bow Common	1,000,000
Bow Common	1,150,000
Bow Common	150,000
Brentford	1,200,000
Brentford	1,250,000
Brentford	350,000
Brentford	750,000
Brentford	6,000,000
Bromley	3,750,000
Bromley	2,250,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,000,000
Bromley	1,450,000
Bromley	1,350,000
Fulham	2,500,000
Fulham	1,700,000
Grays	250,000
Grays	400,000
Grays	725,000
Ilford	650,000
Ilford	750,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Kensal Green	2,250,000
Nine Elms	2,750,000
Nine Elms	750,000
Nine Elms	1,870,000
Nine Elms	2,850,000
Shoreditch	900,000
Shoreditch	2,700,000
Shoreditch	2,725,000
Southall	2,000,000
Southall	3,000,000
Staines	600,000
Stratford	1,700,000
Stratford	850,000
Stratford	2,350,000
Stratford	2,350,000
Gelsenkirchen	625,000
Geneva	500,000
Geneva	700,000
Geneva	1,270,000
Gennevilliers	10,600,000
Gennevilliers	2,900,000
Girvan	235,000
Glasgow	3,000,000
Glasgow	2,500,000
Glasgow	2,250,000
Glossop	340,000
Gloucester	800,000
Gloucester	1,000,000
Gosport	200,000
Gosport	225,000
Göteborg	300,000
Göteborg	600,000
Goteborg	1,000,000
Graudenz	200,000
Groningen, Holland	500,000
Groningen	1,250,000
Guest Keen & F.	1,936,000
Guildford	350,000
Guildford	200,000
Guildford	350,000
Guildford	1,100,000
Guildford	150,000
Haarlem	850,000
Hamburg	1,750,000
Hampton Court	500,000
Hampton Court	600,000
Hampton Court	1,100,000
Hanley	800,000
Hanley	800,000
Hartlepool	750,000
Hartlepool	765,000
Hastings	1,250,000
Haywards Heath	470,000
Haywards Heath	500,000
Hebden Bridge	200,000
Heidelberg	200,000
Hereford	525,000
Hertford	197,000
Hertford	244,000
Hessle	150,000
Heywood	500,000
High Wycombe	752,000
Hilversum	850,000
Hilversum	1,000,000
Hinckley	250,000
Holyhead	197,000
Hong Kong	450,000
Hong Kong	450,000
Hornsey	1,000,000
Hornsey	1,000,000
Hornsey	750,000
Hornsey	750,000
Horsham	235,000
Houillère de Lievin	2,900,000
Hull	1,500,000
Hull	1,000,000
Hull	1,600,000
Innsbruck	200,000
Ipswich	750,000
Ipswich	1,250 000
Ipawich	600,000
Jersey	564,000
Jersey	564,000
Kampen	350,000
Karlsbad	350,000
Kendal	329,000
Kidsgrove	235,000
Kiel	1,000,000
Kiel	880,000
Kilmarnock	500,000
Kilmarnock	585,000
King's Lynn	197,000
King's Lynn	400,000
Kingston-on-Th	3,400,000
Kirkintilloch	360,000
Kirkintilloch	827,000
Kolozvar	100,000
Lancaster	500,000
Langley Mill	500,000
Largs	235,000
Lausanne	250,000
Lausanne	385,000
Lausanne	970,000
Lea Bridge	350,000
Lea Bridge	350,000
Lea Bridge	Cu. Ft. Daily
Lea Bridge	400,000
Lea Bridge	1,000,000
Lea Bridge	1,500,000
Lea Bridge	1,334,000
Leamington	600,000
Leamington	525,000
Leatherhead	705,000
Leeds	1,500,000
Leeuwarden	400,000
Leicester	2,700,000
Leiden	500,000
Leiden	575,000
Leigh	350,000
Lemberg	260,000
Lemberg	500,000
Letchworth	362,000
Letchworth	423,000
Liege	1,000,000
Liége	750,000
Lille	960,000
Lincoln	500,000
Lincoln	893,000
Littlehampton	500,000
Liverpool	3,500,000
Liverpool	4,500,000
Liverpool	750,000
Liverpool	1,750,000
Liverpool	1,250,000
Liverpool	3,000,000
Liverpool	1,500,000
Liverpool	1,250,000
Liverpool	2,350,000
Liverpool	3,000,000
Liverpool	8,600,000
Long Eaton	430,000
Long Eaton	170,000
Longton	600,000
Louvain	800,000
Lubeck	400,000
Luton	400,000
Luton	300,000
Maastricht	200,000
Macclesfield	800,000
Magdeburg	1,400,000
Maidenhead	225,000
Maidenhead	225,000
Maidenhead	175,000
Maidenhead	175,000
Maidenhead	200,000
Maidenhead	200,000
Maidstone	500,000
Maidstone	500,000
Malines	500,000
Malines	575,000
Malmo	350,000
Malta	400,000
Manchester	3,500,000
Manchester	3,500,000
Manchester	1,500,000
Mansfield	330,000
Mansfield	493,000
Margate	960,000
Marlborough	100,000
Mayence	700,000
Melbourne	5,000,000
Merthyr Tydfil	300,000
Merthyr Tydfil	200,000
Middlesbrough	1,250,000
Middlesbrough	750,000
Middlesbrough	900,000
M.M. Woolston	9,000,000
Minehead	300,000
Monaco	275,000
Monaco	618,000
Monaco	618,000
Monaco	400,000
Complete Gasification	
Mons	500,000
Montevideo	1,222,000
Morecambe	333,000
Moscow	1,000,000
Munich	1,400,000
Namur	175,000
Narbonne	350,000
Nelson	400,000
Nelson	350,000
Neuchâtel, Switz.	250,000
Neuss	140,000
Newbury	250,000
Newcastle	2,500,000
Newcastle, N.S.W.	500,000
Newhaven	235,000
Newport Pagnell	188,000
Nice	900,000
Nice	1,295,000
Nictheroy	250,000
Nimes	420,000
North Middlesex	200,000
North Middlesex	200,000
North Middlesex	1,000,000
North Middlesex	1,600,000
North Middlesex	800,000
Complete Gasification.	
North Middlesex	900,000
2nd Complete Gasification.	
North Sydney	500,000
North Sydney	500,000
Norwich	1,000,000
Norwich	300,000
Norwich	500,000
Norwich	1,500,000
Nottingham	1,000,000
Nottingham	1,000,000
Nuneaton	125,000
Oberhausen	175,000
Oldbury	500,000
Oldenburg	200,000
Ormskirk	170,000
Ostend	100,000
Ostend	200,000
,, Zandvoorde	700,000
Oxford	4,500,000
Palermo	968,000
Palermo	850,000
Paris:	
Clichy	4,000,000
Ivry	2,355,000
Landy	6,000,000
Landy	6,000,000
Landy	5,225,000
La Villette	4,000,000
La Villette	2,000,000
La Villette	2,000,000
Paris-Plage	125,000
Pau	550,000
Pavie	194,000
Pavie	212 000
Pembroke	240,000
Perigueux	330,000
Perth, W.A.	125,000
Perth, W.A.	1,000,000
Petone, N.Z.	200,000
Piggott & Co.	1,500,000
Plymouth	2,000,000
Poitiers	350,000
Pontypool	120,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth	2,000,000
Portsmouth	800,000
Portsmouth	2,000,000
Posen	450,000
Posen	700,000
Prague	140,000
Preston	1,400,000
Ramsgate	433,000
Reading	1,000,000
Reading	1,000,000
Reading	600,000
Redditch	500,000
Redhill	275,000
Redhill	300,000
Redhill	1,100,000
Redhill	625,000
Reichenberg	400,000
Reval	350,000
Rhymney	175,000
Rhymney	250,000
Riddings	258,000
Ripley	120,000
Rochester	2,200,000
Rochester	2,800,000
Romford	300,000
Romford	350 000
Romford	1,200,000
Rotterdam	850,000
Rotterdam	1,500,000
Rotterdam	750,000
Rotterdam	750,000
Rotterdam	600,000
Rotterdam	2,000,000
Rotterdam	500,000
Routers, Belgium	250,000
Royston (Yorks.)	250,000
Rugby	1,000,000
Rugby	450,000
Rushden	425,000
Rushden	517,000
Rushden	225,000
Ryde	600,000
Ryde	600,000
Saffron Walden	235,000
St. Albans	700,000
St. Albans	580,000
St. Albans	1,500,000
St. Andrews	210,000
St. Andrews	409,000
St. Gallen	225,000
St. Gallen	225,000
St. Nicolas, Belgium	250,000
Sté. Ch.Gr. Paroisse	1,320,000
Sté.Ch.Gr Paroisse	2,900,000
Sté. I. & F. de Lens	1,130,000
Sté. I. & F. de Lens	1,130,000
Sté. Kuhlmann	1,285,000
Sté. Kuhlmann	3,200,000
Sté. Kuhlmann	2,150,000
Sté. Kuhlmann	3,830 000
Sté. Tubes Meuse	545,000
San Paulo	700,000
Scarborough	300,000
Scarborough	200,000
Scarborough	350,000
Scarborough	1,300,000
Scarborough	1,350,000
Seaford	200,000
Shanghai	225,000
Shanghai	225,000
Shanghai	1,600,000
Shanghai	2,200 000
Shanklin	259,000
Shanklin	400,000
Sheerness	200,000
Sheerness	180,000
Sheerness	200,000
Sheerness	220,000
Sheffield	1,530,000
Sheffield	3,000,000
,, Steel Prods.	3,000,000
Shirebrook	500,000
Shrewsbury	300,000
Shrewsbury	170,000
Sidmouth	225,000
Singapore	600,000
Sittingbourne	259,000
Southampton	800,000
Southampton	500,000
Southampton	600,000
Southampton	100,000
Southampton	1,000,000
Southampton	1,450,000
Southend	1,250,000
Southend	900,000
Southend	900,000
Southend	600,000
Southgate	400,000
Southgate	500,000
Southgate	800,000
Southgate	500,000
Southport	750,000
Southport	900,000
Southport	900,000
Southport	450,000
South Shields	650,000
South Shields	1,250,000
Stafford	500,000
Stafford	750,000
Stettin	880,000
Steyning	150,000
Stirling	400,000
Stirling	970,000
Stockholm	1,500,000
Stockholm	1,750,000
Stockport	600,000
Stockport	600,000
Stockport	400,000
Stockport	400,000
Stockton	500,000
Stockton	250,000
Stourbridge	500,000
Stourbridge	500,000
Sunderland	2,250,000
Sunderland	300,000
Sunderland	475,000
Sutton	1,269,000
Sutton	1,625,000
Swanage	300,000
Swansea	750,000
Swansea	1,000,000
Swansea	450,000
Swansea	1,250,000
Swansea	2,000,000
Swindon	300,000
Swindon	450,000
Swindon	400,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	1,000,000
Sydney	8,250,000
Sydney	2,750,000
Taunton	225 000
Taunton	350,000
Tawe Valley	275,000
Teignmouth	200 000
The Hague	1,000,000
The Hague	500,000
The Hague	1,750,000
The Hague	1,500,000
The Hague	775,000
The Hague	1,500,000
The Hague	2,930,000
Tilburg	400,000
Tirlemont	120,000
Tokyo	2,200,000
Torquay	350,000
Torquay	350,000
Torquay	320,000
Tottenham	750,000
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Tottenham	500,000
Tottenham	1,000,000
Toulouse	1,800,000
Toulouse	785,000
ToulouseNatl Wks.	2,400,000
ToulouseNatl Wks.	6,200,000
ToulouseNatl Wks.	3,720,000
Tournai	700,000
Tours	550,000
Trowbridge	250,000
Trowbridge	150,000
Tunbridge Wells	1,000,000
Tunbridge Wells	1,000,000
Tunis	175,000
Tynemouth	1,100,000
Tynemouth	1,100,000
Ulm	400,000
Union Chim.-Belge	1,977,000
Utrecht	1,000,000
Utrecht	1,000,000
Uxbridge	752,000
Uxbridge	1,000,000
Vancouver	3,830,000
Verviers	1,000,000
Vevey, Switz.	650,000
Victoria, B.C.	1,500,000
Vienna	3,500,000
Vienna	2,500,000
Walsall	750,000
Walsall	375,000
Waltham	400,000
Waltham	140,000
Walton-on-Thames	970,000
Wandsbek	125,000
Wandsworth	1,800,000
Wandsworth	4,230,000
Wanganui, N.Z.	376,000
Ware	150,000
Ware	282,000
Warwick	125,000
Wasmuel	500,000
Watford	300,000
Watford	350,000
Watford	400,000
Watford	1,250,000
Wath	431,000
Weimar	100,000
Wellingborough	525,000
Wellingborough	525,000
Wellingborough	550,000
Wellington, N.Z.	350,000
Wellington	300,000
West Bromwich	550,000
Westgate	250,000
Weston-Mare	350,000
Weston-Mare	350,000
Weston-Mare	150,000
Weston-Mare	500,000
Wexford	100,000
Weymouth	400,000
Weymouth	100,000
Weymouth	658,000
Whit-table	423,000
Widnes	500,000
Wiesbaden	850,000
Wigston	250,000
Winchester	225,000
Winchester	125,000
Winchester	410,000
Winchester	350,000
Woking	400,000
Wolverhampton	1,500,000
Wolverhampton	1,000,000
Wolverhampton	250,000
Wolverhampton	400,000
Worthing	525,000
Yarmouth	500,000
Yarmouth	125,000
Yeovil	340,000
Zwolle	200,000
Zwolle	200,000
Zwolle	700,000

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CONTENTS

ANNUAL MEETING OF THE I.G.E.

REVIEW OF PROCEEDINGS 717
The President 719
The 1932 Medallists 723
Some of the Institution New Members . . 725
The New President 727
The Vice-President 728
New Members of the Institution 732
The Institution Benevolent Fund 736

OFFICIAL VISITS AND SOCIAL EVENTS.

A Tour of Liverpool 737
M.V. "Georgic" 737
The Gas Company Entertains 737
Port Sunlight 737
The President's Luncheon to the Council . 737
Garston Works of the Liverpool Gas Company 738
Jacob's Biscuit Works 738
Civic Hospitality 738
Golf on May 29 740
Crowlands Gas-Works of the Southport Corporation 740
In North Wales 742

COMMUNICATION.

Presidential Address of Mr. Ralph Ernest Gibson, M.Inst.C.E., M.Inst.Gas E. . . 733

I.G.E. MEETING —*(continued).*

DISCUSSIONS ON—

The Coke Oven Plant at Beckton Gas-Works. By R. W. Hunter, M.Inst.Gas E. 743
Electrolytic Corrosion in Gas Mains. By Dr. W. Beck 747
Heating Buildings by Gas. By Arthur H. Barker, B.Sc., M.Inst.C.E., M.I.Mech.E. 750
Centralized Manufacture and Distribution of Gas in Belgium. By George Evetts, M.Inst.C.E., M.Inst.Gas E. 752
The Development of Gas as an Industrial Fuel. By Joseph E. White 755

CORRESPONDENCE.

Construction of a 3-Million Spirally-Guided Gasholder 759

Personal—
New Knights 759

NEWS OF THE WEEK.

Paragraphs 760
Cookery Demonstrations at Hartlepool . . 760
Poster Display at Olympia 760
South-Eastern Gas Corporation's Offer for Rochester and Gillingham Stock . . . 760
Important Extensions to the B.I.F. . . . 760
Swansea Superannuation and Co-Partnership Schemes 761
Swiss Gas Association Meeting 761
Mr. Frank Ayre—Manager of the Parkinson Stove Company (Aust.), Ltd. 761
Driver of Gas-Driven Lorry Fined for Exceeding Speed Limit 762
Hull and District "K.C.U. Week" . . . 762

SPECIAL ARTICLES, &c.

A Century of Progress—Opening of the International Exposition at Chicago 729
A Technical Signpost to the "JOURNAL"—Vol. 201, January-March, 1933 763
Research on Coal and Coke—Report of the Northern Coke Research Committee for 1932 766
New Plant at Kilmarnock—Formal Inauguration of Installation of Glover-West Verticals 767

LEGAL INTELLIGENCE.

Tar Distillers, Ltd. 774
Steatite and Porcelain Products, Ltd. . . 774

MISCELLANEOUS.

South African Lighting Association, Ltd.—Annual General Meeting 769
Sunderland Gas Company's Special Order . 770
Chester Gas Order—Application Under the Gas Regulation Act 771

GAS MARKETS AND MANUFACTURES.

Stock Market Report 774
Current Sales of Gas Products 774
Contracts Advertised To-Day 774
New Capital Issues 774
Trade Notes 774

Stock and Share List 775

For Advertisers' Index see End of "JOURNAL"—PAGE 781.

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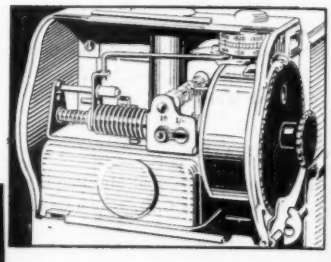

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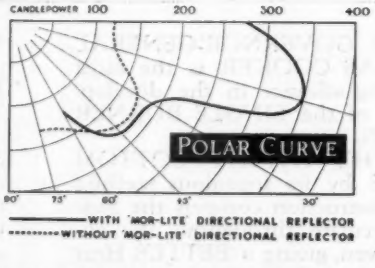
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THE GAS JOURNAL

JUNE 7, 1933

Vol. 202. 85th Year No. 3655

LAST WEEK AT LIVERPOOL

It was in the June of 1914 that the Institution of Gas Engineers held their Annual Meeting in St. George's Hall, Liverpool, under the Presidency of the late Mr. Edward Allen, at the time Engineer of the then Liverpool United Gaslight Company; and many of those who assembled at St. George's Hall on Tuesday last must have had vivid recollections of that meeting, which took place only a few weeks before the declaration of War. Nearly twenty years have elapsed since then and a great change has been forced upon the Gas Industry and the Institution. Enormous progress has been made in all directions. The Institution has been granted a Royal Charter, and enjoys a far more numerous membership. But perhaps the most important change is the closer co-operation which now exists between all groups of the Industry, and between individual undertakings. Anyone who was privileged to attend the Institution Meeting last week must have been impressed by the benefit which has accrued from this co-operation, and by the fact that still greater benefits are to be obtained by extended co-operation.

St. George's Hall makes an admirable meeting place, and allows of that informal conversation prior to, and between, the various sessions which has always been such a feature of these meetings. Whatever criticisms may be levelled against the holding of Institution meetings in the Provinces, one thing was clear—that the Liverpool meeting had a great effect on the Press and the public in the whole of the district, extending to Manchester.

When the President, Mr. Ralph E. Gibson, Engineer to the Liverpool Gas Company, rose to call the meeting to order, he must have been gratified—considering that the meeting was held out of the Metropolis—by the splendid attendance. The Lord Mayor of Liverpool, Councillor Alfred Gates, and Dr. G. C. Clayton, C.B.E., J.P., M.P., Chairman of the Liverpool Gas Company, were there to support the President and to offer a cordial welcome to Liverpool.

A Civic Welcome.

In his formal welcome the Lord Mayor said that the carrying-on of the Gas Undertaking in Liverpool was so satisfactory that he does not recollect having heard of any complaint of any description for a great many years. He mentioned the magnitude of the Gas Industry and its potentialities for serving the community, and he referred particularly to the growth of the Liverpool Gas Company, explaining to those present that since 1900 the sales of gas by the Liverpool Company have more than doubled, and now stand at a figure of 7294 million c.ft.—a significant fact in view of the loose opinion sometimes expressed that electricity is destined to elbow-out gas. The Lord Mayor also spoke of the service of the Gas Industry in making Great Britain a healthier nation.

In his gracious speech of welcome, Dr. Clayton, having referred to the previous occasion on which the Institution visited Liverpool, said how pleased the Company were to have the honour of the Presidency of the Institution conferred once again on an Engineer of the Company. The Company, he remarked, owe a very great debt of gratitude to their Engineers, many of whom were highly eminent men. We are in Liverpool, he remarked, extremely fortunate in enjoying such cordial relations with the Corporation—a state of affairs which makes an enormous difference to the progress and prosperity of the undertaking. He expressed gratitude to the Lord Mayor for his kindness in opening the proceedings and for the hospitality he offered the Institution.

Mr. Gibson also spoke of the cordial relations between the Gas Company and the various Departments of the Corporation, and, in thanking the Lord Mayor and Dr. Clayton, said how much he appreciated the consideration of the Chairman and Directors of the Liverpool Gas Company in allowing him to undertake the duties of President.

The next item on the Programme was the President's welcome to the representatives of Overseas Gas Associations, and members present from abroad. He said how glad they were to have with them Dr. W. Beck, of Berlin, and Mr. Harold Tindale, General Manager and Secretary of the Australian Gas Light Company, Sydney.

Greetings from Overseas.

The Secretary, Mr. J. R. Willis Alexander, then read greetings from Overseas Associations. He said that greetings had been received from Dr. F. Escher, President of the International Gas Union, Zurich; that there was a telegram from Mr. Arthur Hewitt, the English-born President of the American Gas Association, and Mr. Alexander Forward, the Managing Director. There were letters of regret—all expressing good wishes for the success of the meeting—from the German Association of Gas and Water Engineers; from Dr. Schütte, Bremen; from the French Association, and from a frequent visitor of that Association to England, Monsieur A. Baril; from the Dutch Gas Association, and from Mr. Rutten, who has also been a visitor to the Institution meetings; and also from the Swiss and Swedish Gas Associations, and from the Czecho-Slovakian Gas and Water Association.

The minutes of the meetings in June and November last year were confirmed and signed.

Increased Membership and New Research.

We commenced the business of the meeting when the President moved that the Annual Report for 1932-33 be taken as read—a motion which met with no comment. A gratifying feature of the Report is the increase in membership of the Institution. At Dec. 31 last the membership stood at 1477—a net increase of ten. We shall soon be on the 1500 mark.

Most of the Report is a résumé of what took place at the meetings in June and November of last year, but our readers will be interested in the new research which has been embarked upon. At the Leeds Gas Department the Joint Research Committee is continuing its examination of products of combustion by an investigation into the production of sulphur acids in combustion, their corrosive effects, and the resistances of various materials to that corrosion. At the Croydon Gas-Works the Committee is investigating the methods of chemical control most applicable in selected works processes, commencing with water gas.

A feature of the work of the Liquor Effluents and Ammonia Sub-Committee is a comparison of the suitability of sulphate of ammonia and ammonium bicarbonate for agricultural purposes. These experiments are being carried out at the Rothamsted Experimental Station.

The Industrial Gas Committee, formed in 1932, is co-

operating with the Joint Co-Ordinating Committee of the Institution, the National Gas Council, and the British Commercial Gas Association, which was set up this year to extend the uses of gas, particularly for commercial and industrial purposes by, *inter alia*, completing the establishment of adequately staffed and financed Development Centres throughout the country and ensuring co-ordination and the exchange of information between these Centres.

The Refractory Materials Joint Sub-Committee was reconstituted this year, so as to be representative of the Institution, the Society of British Gas Industries, and the British Refractories Research Association. It has issued a questionnaire on the durability of refractory materials in gas-works, upon which an investigation will be initiated, and it is revising the Standard Specifications for Refractory Materials for Gas-Works. The Gasholder Sub-Committee has investigated the Neunkirchen accident, and is preparing a report.

As last year, the Report of the Gas Education Committee will be presented at the meeting in November. During the ten years the Education Regulations have been in operation the number of entries for the Diploma, Higher Grade, and Ordinary Grade Examinations in Gas Engineering and Gas Supply has increased by 740%, the number of candidates being 60 in 1924 and 504 in 1933.

A further item of interest recorded is the setting-up of a representative Committee to inaugurate a Sir Arthur Duckham Memorial Fund for the promotion of Gas Research.

At this stage in the proceedings Mr. J. Bridge, of Elland, and Mr. A. F. Yates, of Goole, were appointed Scrutineers for the ballots for the election of Officers, Auditors, Members of the Council, and the various classes of membership of the Institution. Mr. C. S. Shapley, of Leeds, proposed their appointment, and Mr. John Terrace, London, seconded.

Presentation of Medals.

The President called upon Mr. J. E. Blundell, of Carlisle, to come to the platform to be presented with the Institution Gold Medal, 1932, for his paper "Ten Years Carbonizing in Vertical Retorts" read at the meeting of the Institution in June last year. Congratulating Mr. Blundell, Mr. Gibson referred to the pioneer work of the author in connection with vertical retorts, and particularly the application of the steaming process. Mr. Blundell, returning thanks, said that the award was one of which any man might be proud. He was particularly pleased to receive the Medal in his native county and only a few miles from the town of Salford, where he commenced his career in the Gas Industry. He could not accept the Medal, however, without acknowledging the debt he owed to those who had helped him so loyally and unstintedly in his work.

The H. E. Jones London Medal was awarded to Dr. C. M. Walter for his paper "The Use of Gas as a Fuel in Industry, with Special Reference to Future Applications," also read at the June Meeting of the Institution last year; and he, too, took the opportunity of acknowledging the assistance which he had received from an enthusiastic staff.

The Institution Silver Medal, 1932, was awarded to Mr. James Jamieson, of Edinburgh, for his paper "Calorific Values and their Relation to Working Results and Costs" read at the Annual Meeting of the North British Association of Gas Managers, on Sept. 8, 1932.

The final award, the Institution Bronze Medal, 1932, was presented to Mr. W. N. Smirles, of Birmingham, for his paper "A Review of Domestic Heating Apparatus" read before the Midland Junior Gas Association last year.

A Broad Survey.

The President then rose to deliver his Presidential Address, in which, after referring to the meeting of the Institution in Liverpool in 1914, and giving a few interesting historical notes on the progress of the Liverpool Gas Company, he surveys broadly the present state of affairs in the Gas Industry. He points to the magnitude of the Industry, but urges the need for greater action to extend the uses of gas. To emphasize this he quotes the results of a census of gas appliances recently taken in a large city. Of the premises visited only two-thirds were provided with gas cookers, and only 3% with water heaters other than wash coppers. The average number of gas fires per house was only 0·59. "If," he says, "these statistics are representative of other towns, there is clearly a vast field for further development. Much publicity work remains to be done, particularly by gas undertakings themselves. The times demand greater energy and activity in our sales organization than ever before. If the work is tackled with zeal and enthusiasm, we may look forward to a large expansion in our business."

Calling attention to the setting up of Gas Development Centres this year, Mr. Gibson asks for whole-hearted support of this movement—a movement which is not solely a large scale Industrial Gas Campaign. It is one which embraces the application of Gas for every conceivable purpose for which Gas is suitable, including the requirements of bakeries, catering establishments, and the heating of public buildings. If the opportunity which the Scheme affords is neglected, much business may be irretrievably lost.

Hydrogenation, motor fuel—gas, benzole, and creosote—labour in the Industry, and coke are touched on by the President. As a result of his work in Liverpool, Mr. Gibson is well fitted to discuss the question of the production and marketing of high-temperature coke.

As ordinarily supplied, he observes, gas coke is not as popular as it deserves to be. While it is used extensively in closed boilers and heating stoves, it has not made much headway as a fuel for the open domestic grate. This is accounted for, to some extent, by variation in quality, high ash content, too much moisture, difficulty of ignition, or unsuitable size. By suitable selection and blending of coals, by dry cooling and grading to suitable size, and by taking care to maintain a uniform quality, an excellent fuel can, however, be obtained on the gas-works. Mr. Gibson suggests that it is inadvisable to call such special fuel "gas coke." A name should be given it, which would guarantee its uniformity and excellence of quality. If the fuel is to be generally acceptable, it must be capable of being easily ignited and successfully burnt in any ordinary grate.

Appreciation.

A vote of thanks to the President for his Address was proposed by Mr. Thomas Hardie and seconded by Mr. Samuel Tagg. Mr. Hardie congratulated the Liverpool Gas Company on having had such a continuous succession of engineers eminent in the profession and who had taken such a prominent part in the work of the Industry—a tradition which had been well maintained by Mr. Gibson. Also, it was only fair to congratulate their President on having such a progressive and sympathetic Board of Directors. As for the Address, every line was worthy of emphasis. Mr. Tagg remarked that, apart from the numerous occasions when the President spoke there was always what might be termed his inarticulate address as typified by his influence and his personality during his year of office, and which was of such enormous value to the Industry. "I appreciate very much the opportunity of seconding this vote of thanks," concluded Mr. Tagg, "because as a Lancashire colleague I can, on behalf of those other Lancashire engineers who are so closely associated in all the collective work of the Industry with our President, express our appreciation of that unremitting assistance and that willing co-operation with any member of the Industry in this area, as well as that wise guidance which he constantly exercises to assist the Industry in this particular area."

The vote of thanks was carried with hearty acclamation.

The Coke Ovens at Beckton.

To Mr. R. W. Hunter, Engineer at the Beckton Gas-Works, was allotted the task of opening the technical business of the meeting by presentation of his paper on the coke oven plant at Beckton. The paper supplements the notable contribution of Mr. E. G. Stewart to the proceedings of the Institution meeting in Leeds in 1930. Mr. Stewart, it will be remembered, discussed the functions of coke ovens, dealing with the question in its widest aspect, but he also made particular reference to the plant which was then under construction at Beckton. The installation of Koppers combination ovens and ancillary plant followed very closely the lines described by Mr. Stewart, so Mr. Hunter refers to unusual developments incidental to the installation, and important variations in the equipment and operation of the plant. He indicates how far the results anticipated have been realized or improved upon.

The paper gives a clear idea of the magnitude of the task which was involved in laying the foundations for the installation, planning the site (10 acres), re-arranging the method of dealing with purified coal gas and carburetted water gas, bringing the plant into operation, and ensuring that it operates smoothly, continuously, and efficiently. A length of about 1000 yards of roads has been laid to give access to the plant, and the provision of railway access means the addition of six miles of new track to the works railway system. By this installation the capacity of the Beckton Station has been raised to 120 million c.ft. a day. All the changes were made without interrupting the normal work—in itself a triumph of engineering skill.

Every precaution was taken in heating-up the two batteries and starting gas-making, which were carried through without hitch, the cost of heating-up being £3067. The battery is of compound construction, but the rich gas heating facilities are regarded only as stand-by, producer gas

GAS LIGHTS . . . . *by Fred May*

Published by the "GAS JOURNAL."

RALPH ERNEST GIBSON, M.Inst.C.E.

Of Liverpool.
President Institution of Gas Engineers, 1932-33.

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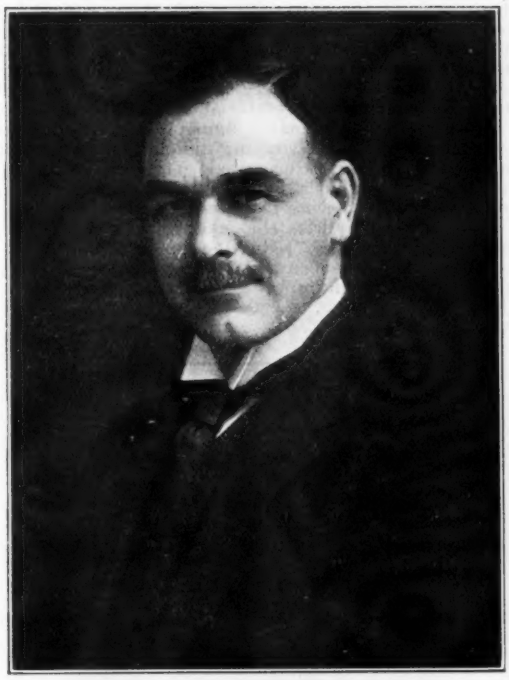
THE PRESIDENT

Mr. Gibson is Chief Engineer to the Liverpool Gas Company, the largest of the Company-owned Undertakings in the Provinces, having an annual output of over 8000 million c.ft. of gas. His connection with the Company has extended over a period of nearly 29 years. He joined the Company in 1904, when he was appointed Assistant Engineer. For eleven years he was largely responsible, under the late Mr. Edward Allen, Chief Engineer, for the design and construction of extensive alterations and additions to the manufacturing plant, including a large amount of labour-saving machinery. On the death of Mr. Allen in July, 1915, Mr. Gibson was appointed Chief Engineer, and was responsible for the administration of the Company on the technical side during the difficult period of the war, continuing in that position up to the present time. During this latter period many improvements have been carried out. The carbonizing plant has been modernized throughout, the obsolete works at Caryl Street have been closed down, new coal gas-works have been constructed at Garston, the distributing system has been improved and greatly extended, and two Gas Undertakings have been absorbed—viz., Hightown Gas Company and Woolton Gas Company. One of the latest developments has been the production of the new smokeless fuel "Dryco," by high-temperature carbonization. Mr. Gibson was President of the Manchester District Institution of Gas Engineers in 1923 and President of the Liverpool Engineering Society in the year 1924. He was educated at the Sheffield Royal Grammar School, and received his early training in the Works and Drawing Office of Messrs. Newton, Chambers, & Co., Ltd., where he served a pupil-apprenticeship of six years. He was afterwards engaged for a period of four years on Messrs. Newton, Chambers, & Co.'s staff in designing gas-works plant and other engineering structures, surveying sites, preparing plans, specifications, and estimates, and also in supervising erection. During this time he studied Mechanical Engineering and other subjects at the Sheffield Technical College. In 1899 he was appointed Engineering Assistant to the Huddersfield Gas Department, and for nearly five years was engaged there on renewals, extensions, and general supervision of the manufacturing plant and distributing system. From there he went to Liverpool. Mr. Gibson has contributed several papers on technical subjects to various Associations, the Liverpool Engineering Society having awarded him its Premium for a paper entitled "The Mechanical Handling of Materials on Gas-Works," and the Institution of Gas Engineers the "H. E. Jones" London Gold Medal for a paper entitled "Construction of the New Coal Gas-Works at Garston."



RALPH ERNEST GIBSON, M.Inst.C.E.

being employed for firing. Mr. Hunter states that remarkably even heating from top to bottom of the ovens is maintained on producer gas. The working of the producer plant is laid out to ensure absolute continuity of operation.

Working Results.

The working results of the coke oven plant at Beckton have been eagerly awaited. Before giving general conclusions, Mr. Hunter explains that in practice the capacity of the installation is 1290 tons of coal a day instead of the specified 1200 tons. The yield of gas is correspondingly increased, and the calorific value can be maintained at a high figure. The guarantee figures were 71 therms per ton at 525 B.Th.U. per c.ft. The figures for the guarantee test, however, were 71·87 therms at 585·6 B.Th.U.; while another 4-weeks' test, also on gas coal, gave 75·62 therms per ton at 573·6 B.Th.U. Thus the gas produced by the ovens is comparable in calorific value with that obtained from horizontal retorts and richer than normally produced by any type of vertical. It is suitable for undertakings supplying gas at a high calorific value standard or for profitable recovery of benzole and/or admixture with carburetted water gas. In regard to the cost of production of gaseous therms and in the conditions obtaining in the Gas Light and Coke Company, the ovens are on almost equal terms with intermittent verticals, the balance of 0·07d. per therm being slightly in favour of the latter. To what extent the incidence of the wear and tear costs in each of these cases will ultimately affect the comparison remains to be proved. Any marked improvement in the price of coke would favour the coke ovens, owing to the larger proportion available for sale. Allowing for ultimate re-setting charges, the figure of 7½d. is given for maintenance costs of the ovens and producers.

Demand for Oven Coke.

The oven coke is gradually finding its place in the market and is giving satisfaction to many customers. In many cases it is replacing raw coal, and, in the nut size, is being used to some extent as a substitute for anthracite. The small grade for forge work has also proved acceptable. There has been a considerable demand for coke of large size, and some success has been attained in blending coals to give this product. On the other hand, there is a growing demand for an intermediate size for boilers at laundries, bakeries, and other establishments where heavy increases in steam output are called for at short notice. The boiler nuts are proving very satisfactory for domestic boilers, except for the smallest types, which call for a special grade of fuel. It is found, however, that difficulties may arise when customers are supplied with oven coke nuts after becoming accustomed to fuel produced in vertical retorts, and *vice versa*, owing to slight differences in the correct adjustments of air and draught. An advantage in the case of oven coke is the absence of shale without the need for washing, due to the cleaning action of the Bradford breakers, and the fine crushing in the hammer mills resulting in the even distribution of the remaining ash throughout the fuel. Experiments are being carried out with coal prepared in this way for carbonizing in horizontal retorts.

In the various grades the Beckton oven coke is holding its own in competition with oven coke from other sources, including imports from the Continent, some of which is offered in the London district at comparatively low prices. Although it is on equal terms with retort coke for many purposes, and is even preferred for certain industrial uses, the fact remains that there is, in the Company's area, a definite and very considerable demand for special purposes—*e.g.*, domestic open fires—for lighter cokes produced in other types of carbonizing plant.

Mr. Hunter states that the choice of a coke oven installation for Beckton Works has been justified by results. From the point of view of future increase of capacity, an extension of the ovens could be made with very important economies in capital expenditure and operating costs, as much of the equipment has a capacity equal to double the present installation. The concluding paragraph of the paper is as follows: "So far as is known, the Beckton coke oven installation is as well adapted to the requirements of a gas company as any in existence. . . . The conclusion may be reached that, for the purpose of gas manufacture, coke ovens are not likely to prove superior to certain other systems of carbonizing unless specially favourable prices can be obtained for the types of coke produced."

"*A Qualified Lead.*"

Discussion on the paper was opened by Mr. Thomas Hardie, who explained that the ovens were installed at Beckton so that his Company might have complete and re-

liable information as to the possibility of making gas more cheaply in large carbonizing units producing furnace coke, than in the plants in general use in the Industry. The whole equipment of the plant was designed with a view to giving really good gas-making results. The standard of work throughout the installation, he said, was of a very high order, and the ease with which the excellent results were obtained at comparatively low combustion chamber temperatures points to a low wear and tear figure and a long life for the ovens. He noticed that the author had taken the same wear and tear figure for intermittent retorts as for continuous retorts; and he called attention to the fact that the maintenance figure for continuous retorts has become less because spalling difficulties, formerly common when Durham coal was used, are being steadily overcome. "The author's figures," remarked Mr. Hardie, "are all based on the use of unscreened Durham coal, but our experience so far with the coke ovens is that we do not think we shall get any reduction in cost in making gas as compared with modern gas-making plants. If the price of oven coke should improve, then the coke ovens may prove a salvation to those companies who have weighted themselves with a high calorific value gas provided they are of a size suitable to such an installation. The application of producer gas to the heating of the ovens has been most successful, and nothing has been more satisfactory than the even temperature through the ovens."

R. W. HUNTER.

Mr. R. W. Hunter was educated in Chester, commencing his career in 1897 as pupil of his father, the late Robert Hunter, Engineer and Manager of the Chester United Gas Company, and of his successor, Mr. J. C Belton. He studied chemistry and mechanical engineering, &c., at the Chester Technical School, and later, at the Polytechnic, London. He took 1st Class Honours (City and Guilds Institute), in gas manufacture in 1904. In 1902 he entered the service of the Gas Light and Coke Company at their Kensal Green Works, and was transferred to Beckton in 1903, where he was a Senior Assistant Engineer in charge of a section of that Works on the outbreak of war Mr. Hunter held a commission in the 12th London Regiment "Rangers" (which is mainly composed of Gas Light and Coke Company personnel, with the Governor of the Company as Hon. Colonel), and proceeded to France with the 1st Battalion, in 1914. After serving throughout the war until invalided out in 1918, he returned to Beckton, where he has since remained, with the exception of a period of two years as Deputy Engineer at Bromley-by-Bow. After a period as Senior Officer in charge of the Works during the serious illness of Mr. W. B. Leech, on the transfer of the latter to the Chief Office of the Company, Mr. Hunter was appointed Station Engineer at Beckton in 1928. He joined the old Gas Institute as an Associate Member in 1900, and is now a member of the Institution of Gas Engineers, of the Institute of Fuel, and of the Southern Association of Gas Engineers and Managers.

The next speaker, Mr. F. P. Tarratt, who commented—as also did Dr. E. W. Smith and Mr. N. J. Bowater later—on the cause of the remarkably high naphthalene figure, said it was a consolation to those who were not in a position to put down a battery of coke-ovens to know that the cost of manufacture both in continuous verticals and intermittent verticals compares very favourably indeed with the coke ovens, and that they are not going to derive such an enormous benefit from the use of coke ovens as regards the cost per therm into the holder.

A highly interesting contribution to the discussion was made by Dr. Smith, who sums up the experiment as an entire success from the Gas Light and Coke Company's point of view, but as a qualified lead from the viewpoint of the Industry as a whole. It would appear, he said, that coke ovens are only justified if it is possible to afford to install a large battery of a capacity of 1000 tons of coal or more per day—a matter of little interest to the large bulk of members of the Institution. On the other hand, with increasing centralized production, coke ovens may become of supreme importance. Again the justification for coke ovens is largely dependent on a proper sale for coke at an enhanced price over normal gas-works practice. Dr. Smith criticized Mr. Hunter's statement that producer gas for heating-up the battery gave a better control than the use of direct coal firing. Nor does Dr. Smith think that in the paper a case has been made for mechanical producers on the score of either capital cost or operation charges.

An important point in regard to the distribution of ash in the coke was made by Mr. H. D. Madden, who asked the author whether he attributes the easy ignition of his coke to the effect of coal crushing and the better distribution of ash throughout the coal in the charge. To this the author replied that the Bradford breaker followed by the hammer mill crushing constituted a most valuable asset. As a result the ash is so distributed that there is no possibility of any shale, and very little danger of clinker in the ordinary way of working. Once the customers get accustomed to coke made in the Beckton ovens it behaves with great regularity, and it has become highly popular for use in domestic boilers and for many industrial purposes. It is not being sold as a fuel for the open firegrate.

Mr. Bowater said that it was wrong for the author to suggest that he is working at high combustion temperatures, and maintained that the primary coolers are inadequate for the work they are called upon to do. The author responded that the temperature at the top of the charge is higher than that of normal coke oven working. An excess of naphthalene is, he said, due to production deliberately of high gaseous thermal yield. The naphthalene troubles experienced were due to a deliberate intention of working the primary coolers to deliver gas at 35° C. It was the intention to obtain ammoniacal liquor from them which was free from free ammonia, because this was advantageous to the system of ammonia extraction which he practised. He is now fully satisfied with the general operation of the coke ovens and the cooling plant.

Electrolytic Corrosion.

The afternoon session was devoted to the important paper by Dr. W. Beck, of the Kaiser-Wilhelm Institut, on electrolytic corrosion of gas mains. In this the author points out that, when exact measurements of stray currents in the neighbourhood of underground pipe and cable systems are made by the customary methods, it is necessary to dig up the ground. The original structure of the ground is thereby changed in an uncontrollable manner, so that considerable errors are likely to be introduced into the calculation of the current density for the curved surface of the pipe, from the measurements made with a flat electrode. Moreover, it is almost impossible in practice to ascertain accurately the conditions existing on the outer skin of the metal, which are particularly important in cases of electrolytic corrosion. The methods mentioned are cumbersome and require comparatively complicated instruments, which are expensive and difficult to handle.

A new method has therefore been developed by the author, which employs special electrodes consisting of the same material as the pipe. These auxiliary electrodes are a kind of electric probe, made by cutting a small cylinder segment from an iron or steel pipe of slightly larger diameter than the pipe to be tested. The inside surface of the probe is lined with a thick plate of soft rubber, in such a manner that the edge of the rubber protrudes by a few millimetres beyond the insulated metal edge. The auxiliary electrode is firmly pressed to the pipe by two thick rubber bands. The upper edge of the metal plate has a small hole into which the ends of a lead are inserted. There is reason for the assumption that under these conditions the current flows to earth in approximately the same way as the current from the pipe. The stray current flows thus from the pipe through the metallic connection to the electrode, which is insulated from the pipe by the rubber pad. If a galvanometer is inserted into this connection the instrument records the density of the current for the surface of the electrode. After developing the experimental technique with auxiliary electrodes, a great number of determinations has been made, the reliability of which has been checked by a formula developed by Michalke. Good agreement is found between mean values of the current density, calculated from the measured mean strength of current and the results computed from the maximum and minimum values of the auxiliary electrodes. Good agreement is also

found between the calculated and observed values for various other points on the circumference of the pipe.

An Aid to Pipe Protection.

A method is described by which the risk of attack by stray current or underground metal structures in the vicinity of electric conductors can be found by simple measurements with auxiliary electrodes. An electrochemical method of finding defective places in an applied pipe protection is based on this principle.

Strength of current and time curves have been obtained from the laboratory examination of a large number of new protective coverings in moist soil and in aqueous salt solutions in the laboratory; the measurements are compared with an ocular examination of the test pieces at the end of the tests. Similar experiments have been made at low temperature. The difference in the behaviour of the different protective coatings and bandages is very marked.

An apparatus for the examination of the permeability of a pipe protection exposed to the simultaneous influence of low temperature and bending stress due to vibrations is described, and a number of results obtained from various materials is recorded. It is shown that a double coating of petroleum bitumen on a bitumen-jute wrapping is inferior to a covering consisting of cord impregnated with bitumen or the Denso dressing. The various protective coatings have behaved very differently under the common influence of low temperature and vibrations.

Finally the similarity of the experimental conditions in the laboratory with regard to bending stresses set up by vibrations, and those caused in practice by traffic, is discussed.

Isolation or Drainage?

Several important points emerged from the discussion which took place on the paper. Mr. S. C. Bartholomew,

Dr. WALTER BECK.

Dr. Phil. Walter Beck, born in Berlin on Dec. 7, 1901, studied under the well-known German scientists Fritz Haber and Walter Nernst, and has devoted particular attention to the subjects of corrosion of metals, and the technique of protective covering. His researches on viscometry are well known, and the important part they have played in throwing light on the complex problem of the resistance of lacquers, and in particular of anti-rust paints. Most fruitful were his researches on the subject of the protection of iron pipes against earth corrosion, especially that due to stray currents from electrical railroads. A précis of some of his work appeared in our columns in 1931. Dr. Beck was joint author of a widely read handbook on corrosion and the protection of material, and, as a specialist on the electro-chemical side of the problem of earth currents he attended, in 1932, along with the delegates of the German Ministry of Postal Services, the Annual Conference of the "Commission mixte internationale pour les expériences relatives à la protection des lignes de télécommunication et des canalisations." Up to the present time Dr. Beck, with the support of a number of collaborators, has carried out his scientific work almost exclusively at the Kaiser Wilhelm Institut für physikalische und Elecktrochemie, Berlin-Dahlem, which, as is well known, was until quite recently under the leadership of the famous chemist and technologist, Prof. Dr. Fritz Haber.

of the General Post Office, who has been associated with work on electrolytic action for many years, stated at once that the problem, already serious, is becoming more serious every day. Since the war, the loads on tramways and electric railways have increased, and the amount of stray current circulating in the earth has gone up in proportion. He admitted that, as far as the Post Office is concerned, the problem of dealing with electrolytic action is very much

Mrs. GIBSON.

easier than it is for the Gas Industry, and he suggested that the application of Dr. Beck's method would be difficult in practice, and would necessarily imply interference with the soil. Mr. Bartholomew went on to discuss the theory propounded by Prof. Chappuis; this theory being that, during electrolysis, metal will leave the pipe and eventually produce filaments through the soil, thus decreasing the resistance between the anode and the cathode. This, he said, might be all very well in small-scale laboratory experiments, but work which he had carried out in the field certainly does not support the view.

Turning to the question of attempts to eliminate the effects of stray electric currents by wrapping pipes with protective coverings, he emphasized that, unless the wrapping is entirely free from any holes or pittings, the remedy is worse than the original disease, for the intensive localized action set up will eat away the pipe in a very short time. The Gas Industry, he thinks, regards the whole problem from the defensive point of view, and he thinks also that it would be a good thing if the Industry tackled the problem with the underlying idea of preventing the current reaching the pipes. In this respect there are two schools of thought which may broadly be classified as the American and the European. The American view is to prevent damage to pipes by draining the electricity—by joining the pipes actually to the negative return of the tramway or railway system. A Swiss Committee, composed of all the interests concerned, is unanimous that this method is wrong—that isolation is a better way of preventing damage. This view is taken by most European countries, though Great Britain seems to adopt a half-way attitude. He appealed to the Institution to become members of the Commission Mixte Internationale, to which Dr. Beck referred in his paper.

The next speaker, Mr. C. A. Masterman, also emphasized the need for ensuring that any wrappings used to protect pipes should be intact, and he has come to the conclusion that perhaps the best way of preventing corrosion is to employ wooden troughing and a special type of pitch which has elastic properties and provides a perfect insulation for the pipe against any attack by electrolytic action and also soil corrosion.

Mr. Ulick R. Evans, of Cambridge University, is particularly interested in the author's finding that a cement-like layer is formed on the pipe by electrolytic action, thereby setting up a resistance against attack, and he urges study of inhibitors such as potassium chromate and red lead, which have a specific preventive effect. Mr. F. C. Smith,

of the Gas Light and Coke Company, emphasized the point that we have to protect our pipes not only against electrolytic action, but also against soil corrosion, and that protective coatings effective against electrolysis may be successful against soil corrosion.

The verbal reply of Dr. Beck, who promises a written contribution, was in the hands of Dr. G. W. Anderson, who acquitted himself of an extremely difficult task in a most able manner, and he explained that the author considers that doubts as to the ease with which his method can be applied in practice are unfounded. Dr. Beck, too, he said, is entirely in agreement with the findings of the General Post Office in regard to the theory put forward by Prof. Chappuis. As to the possible rotting of wrappings, mentioned by Mr. Masterman, he agrees that troughing with suitable pitch or bitumen is a very satisfactory method of protection, but suggests that this troughing is expensive, and that if wrappings can be found which are satisfactory they would prove to be very much cheaper.

[*Photo. by Elliott & Fry, Ltd.*

Prof. W. A. BONE, D.Sc., Ph.D., F.R.S.

Prof. William A. Bone, of the Imperial College of Science and Technology, South Kensington, has had a distinguished scientific career. He graduated from Owens College, Manchester, in 1891, and subsequently studied under the late Prof. Victor Meyer at the University of Heidelberg. In 1896 he was appointed Head of the Chemical Department at the Battersea Polytechnic, London. It was in 1898, when lecturer in Chemistry and Metallurgy at Owens College, Manchester, that he started systematic research on the combustion of hydrocarbons and the influence of hot surfaces in promoting gaseous combustion, for which research he was elec ed a Fellow of the Royal Society in 1905. The following year he went to Leeds University to organize and direct what was the First University Fuel Department in this country. There he carried out research chiefly upon gaseous explosions at high pressures and incandescent combustion. In 1911 he visited America to expound his discoveries, for which the Franklin Institute of Philadelphia afterwards awarded him its Howard Potts Gold Medal. In 1912 he returned to London to organize and direct the new department of Chemical Technology at the Imperial College, South Kensington, which has steadily progressed to be one of the largest chemical research centres in the country. His researches have comprised: The chemical constitution of coal, surface combustion, gaseous combustion and explosions under high pressure, photographic investigation of flame propagation during gaseous explosions, combustion of hydrocarbons and blast furnace reactions. He has recently been awarded the Medal of the Society of Chemical Industry in recognition of his researches into the mechanism of combustion. This Medal, which was instituted in 1896, is awarded periodically for conspicuous service rendered to applied chemistry by research, discovery, invention, or improvements in processes. Prof. Bone was Chairman of the British Association Fuel Economy Committee from 1915 to 1922. He was also a member of the Coal Conservation Committee from 1916 to 1919, and from 1917 to 1919 he acted as Consultant to the Fuel Research Board. He has written a great number of scientific memoirs and papers on combustion and fuel technology, and several books on the subject.

Photographing Explosion Flames.

The first part of Wednesday morning's proceedings was devoted to what was agreed to be one of the most noteworthy features of any meeting of the Institution of Gas Engineers—a lecture of absorbing interest by Prof. W. A. Bone on "The Photographic Analysis of Explosion Flames." A summary of this lecture was given in the "JOURNAL" for May 24—our First Institution Number—and the lecture was the same as that given before the Royal Institution in February last, and which was reprinted by that Institution in pamphlet form and is obtainable from the Secretary at the price of 2s. The lecturer was attended by Mr. R. P. Fraser and Dr. Townend, who assisted him in a series of fascinating demonstrations of the phenomena of explosion flames. Mr. Fraser is the inventor of the high-speed cameras which have enabled this delicate experimental work to be brought to a successful conclusion. The latest camera is capable of working at a speed of 30,000 r.p.m., and will project the image of the explosion flame on to a stationary film. With the assistance of this camera much new light has been thrown upon both the development and characteristics of detonation in gaseous explosions. Prof. Bone dealt with pre-detonation phases in explosions and also the phenomenon of spin in detonation, and the slides which he threw upon the screen gave rise to enthusiastic applause, as also did his witty and able delivery of the lecture. There is no doubt at all that fundamental research of the type undertaken by Prof. Bone, himself truly a scientific investigator, is of the utmost value to a knowledge of gaseous combustion.

The thanks of the meeting were expressed by Dr. Clayton, who said that he had attended a great many lectures, but he had never seen such a succession of wonderful experiments, all of which came out exactly as the lecturer said they would. The lecture had proved delightful to them all.

Responding to the vote of thanks, which was carried amid prolonged applause, Prof. Bone said the lecture would have been impossible without the skilled assistance of his collaborators, Dr. Townend, and Mr. Fraser. He would not refer to them as assistants, because for many years they had worked together on these problems.

Central Heating by Gas.

The general business of the meeting on Wednesday morning was brought to a close by presentation and discussion of Mr. A. H. Barker's paper on heating buildings by gas. This outspoken communication is an effort to explain why the progress of the use of gas for central heating has been "so relatively meagre," and to suggest methods of use which would give it a more prominent place in this field, "in which the opening for expansion in the use of gas is almost unlimited."

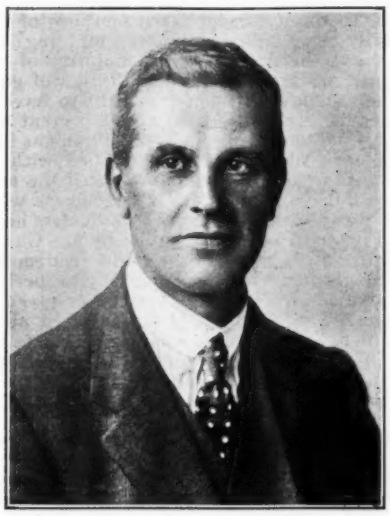
ARTHUR H. BARKER, B.A., B.Sc., M.Inst.C.E., M.I.Mech.E.

Mr. Arthur H Barker was educated at the University of Leeds (Salt Scholar) and the University of Wales (Senior Scholar), while he received his early training with Messrs. Henry Berry & Co., Hunslet (hydraulic), Messrs. Hudswell, Clarke, & Co., Ltd., Leeds (locomotive), Messrs. Gwynne & Co. (engines and centrifugal pumps), where he was General Foreman, and Messrs. Haden & Sons, Trowbridge (heating and ventilating), where he was Manager. In 1912 he set up as a Consulting Engineer at 100, Victoria Street, S.W. 1. Mr. Barker is a Senior Whitworth Scholar, a Past-President of the Institution of Heating and Ventilating Engineers, a member of the Association of Consulting Engineers, a companion of the Institution of Electrical Engineers, and a Fellow of the Institute of Arbitrators. He was responsible for the report to the Department of Scientific and Industrial Research on "Economy of Kitchen Ranges and Gas Appliances," while he has also published a number of books on technical subjects, besides reading numerous papers before several of the Institutions of which he is a member.

The author has arrived at the conclusion that if electricity and gas were treated in the same way as heating agents, the cost of gas might be about half that of electricity for the same service when the prices are in propor-

THE 1932 MEDALLISTS

GOLD MEDAL



J. E. BLUNDELL, M.Inst.C.E.

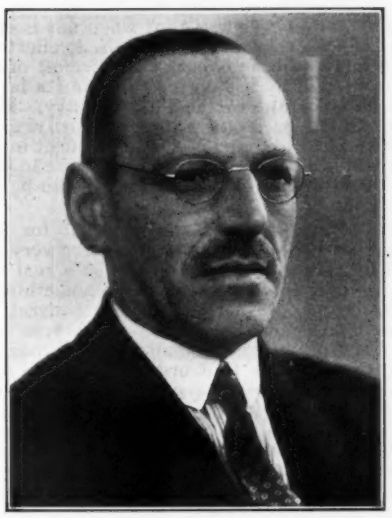
Educated at Southport, Mr. Blundell served under Mr. John Booth, and then under Mr. John Bond, Past-President of the Institution of Gas Engineers In 1914 he was appointed Gas Engineer and Manager at Macclesfield. Four years later he was appointed Engineer and Manager to the Carlisle Gas Department, and there he erected complete new gas-works, which were opened in September, 1922. Mr. Blundell was President of the North of England Gas Managers' Association in the session 1922-23, and President of the Cumberland and Westmorland Gas Managers' Association during 1928 30.

SILVER MEDAL

JAMES JAMIESON.

Mr. James Jamieson, after completing his practical training, joined his father at Thornliebank, ultimately succeeding him as Manager. Successively his grandfather, father, and Mr. J. Jamieson managed this concern. He was transferred to the Dalmarnock Station of the Glasgow Corporation on their acquiring this undertaking. Mr. Jamieson has held appointments as Assistant Engineer and Manager to the Dunfermline Gas Commissioners and Greenock Corporation Gas Department, and for the past twelve years has been Assistant Engineer and Manager, and recently was appointed Engineer and Manager to the Edinburgh Corporation Gas Department.

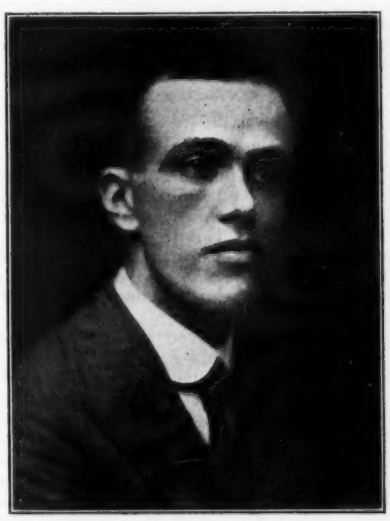
H. E. JONES LONDON MEDAL



DR. C. M. WALTER.

Dr. Walter was educated at King Edward's High School, Birmingham, where he obtained a Foundation Scholarship, and, later on, entered on an engineering course at the Birmingham University. He joined the Birmingham Corporation Gas Department in 1909, where he was engaged in connection with the development of the use of gas for industrial purposes. In October, 1916, the Birmingham City Council approved the establishment of an Industrial Research Laboratory, which resulted in the existing laboratories for the development of gas industrially being considerably extended to cover general testing of all kinds, including heat-treatment work, and mechanical, physical, chemical, and electrical testing, special laboratories being suitably equipped for this purpose in the Council House buildings. In November, 1916, Dr. Walter was appointed Engineer in Charge of these Laboratories, which have since been extended from time to time. During the latter part of the war he was requested by the Ministry of Munitions to act as Arbitrator in the carrying out of a complete series of tests on gas-heated furnaces, which covered the testing of practically the whole of the best designs of furnaces available at that time.

BRONZE MEDAL



W. N. SMIRLES, B.Sc.

Mr. W. N. Smirles was educated at Yardley Secondary School, Birmingham, and on leaving he took up the position of assistant to Dr. F. Johnson, Head of the Metallurgy Department of Birmingham Municipal Technical College, in order to study metallurgy. He was awarded the first "Turner Medal" in 1920. In 1923 Mr. Smirles was appointed Research Chemist under Dr. C. M. Walter at the Birmingham Gas Department Industrial Research Laboratories, where considerable study was made of problems relating to the Gas Industry, notably domestic heating apparatus.

tion of ½d. per unit for electricity and 6d. per therm for gas. Also, that gas, "when suitably handled," is capable in many conditions of producing the heat necessary for warming buildings quite as effectively as, and at a lower cost than, any other fuel, "though there are certain disadvantages attending its use which should be faced and not burked." Mr. Barker's view is that when gas is employed in the same way as coke and oil are used, effective competition on a large scale is hopeless on account of its cost, and the possibility of its use on anything but a large scale is relatively unimportant to the Gas Industry. His point is that there is little or no advantage in purifying, and so increasing the cost of, the fuel if it is to be burnt in a boiler, just as there would be no advantage in a house in incurring the expense of softening water which is only to be used for sanitary purposes.

"It appears," states Mr. Barker, "that for use in a boiler purified gas is now and must always be very severely handicapped by its cost. It could only be a real competitor to oil if its cost could be reduced to something of the order of 3d. or 4d. a therm. As the general cost of generating and purifying the gas at the Works is of the order of 3d. a therm, without distribution and management costs, it seems improbable that ordinary purified town gas can ever be supplied at such a price as to compete effectively with the portable fuels, coke and oil. All the advantages of gas as a fuel for boilers taken together do not seem in the great majority of cases to compensate for the great difference in cost. There are however exceptional cases where these advantages are of greater relative importance than in ordinary cases."

Having urged the Gas Industry to pay more attention to modern coke burning apparatus—in particular the Wollaston producer furnace—Mr. Barker specifies an ideal fuel and considers how far gas approaches the ideal. He admits that, of all heat agencies, gas comes nearest to the fulfilment of this specification; but he maintains that, apart from ensuring complete combustion, the temperature at which the heat is generated should be reduced without sacrifice of the heat itself, by the use of some absorbing medium such as water, and that the products of combustion should in all cases be removed from the room where the heat is required. Up to the present, he states, gas has offered nothing to the public against the competition of electricity but the lower price. Mr. Barker charges the gas fire with many vices. It needs a chimney or its equivalent, the heat is too localized, it has a relatively low efficiency, it is apt to get out of order, the method of ignition and the arrangement of taps are inconvenient, and it is impossible to know at what rate gas is being consumed. As for the "flueless" stove—"a rather euphemistic description of a naked gas flame neatly camouflaged, discharging, as it does, all its products into the air of the room"—the Gas Industry ought to leave this method of heating severely alone. He regards its commercial exploitation as a short-sighted attempt to side-track an essential disadvantage of gas—the generation of products of combustion.

"A Perfect System."

Mr. Barker then describes what he believes to be the perfect gas system. First and foremost, this system must have positive means for evacuating all products of combustion; it must not depend on the presence of a chimney, or the state of the external air, the direction of the wind, and so forth. For many years the author has experimented in the effort to produce an apparatus satisfying these requirements; and he believes that he has now succeeded. The apparatus consists of a gas burner and extended tubular surface immersed in water, the surface being of sufficient extent to absorb 90 to 95% of the gross heat in the gas and to distribute it uniformly over large plates (Rayrads) attached to the walls of a room. The products of combustion are drawn off from the apparatus by an electrically operated suction fan, or alternatively by an ejector supplied with slightly compressed air, and discharged at any convenient point into the outer air. The burners are arranged to be lighted by a pilot jet when turned on by the valve, or automatically, and each burner can be separately controlled by a thermostat so that the amount of gas is proportional to the local demand, and no overheating can occur. Again, the consumption of gas in a large room can be controlled as a whole by one thermostat, which will simultaneously turn down all the burners. As for the running cost of such a system, the author states that a room of 2200 c.ft. capacity can be warmed by 7 c.ft. of gas an hour. No figures are given of the capital cost of the installation, or of the cost of electricity. Mr. Barker's solution to the heating problem is to pipe all houses to which gas is supplied both for extraction and gas supply; and he puts forward two schemes of central heating, hot water supply, and cooking by "local gas" on this principle.

Inevitable Criticism.

It was unfortunate that the time available for discussion on Mr. Barker's paper was so short, for it was obvious that the intended speakers had much criticism to level against the views taken by the author. The discussion was opened by Mr. Stephen Lacey, who complimented Mr. Barker on a highly interesting contribution, and admitted that the system to which the author pinned so much faith—namely, panel heating—may in the future serve a useful and important purpose, and help in the development of the use of gas in new buildings. But its capital cost—a matter of first importance—was all too lightly dismissed by Mr. Barker. Also, in making out his case he had done but scant justice to the well-established methods of heating by gas, especially the heating of existing buildings with flues, which represent the overwhelming majority of cases met. As to the progress made in the installation of gas fires, if, as the author suggested, their use ought to have extended twenty times more rapidly, then at the present time in his own area of supply he would have 12 million gas fires, which meant that each room would be supplied with two fires. Again, the author seriously misrepresented the actual facts in regard to flueless heaters. His statements were in fact untrue. It was absurd to suggest that flueless heaters have been forced upon an unwilling public by the Gas Industry. There is an insistent demand for them—a demand that is being met by gas undertakings supplying properly designed flueless appliances. Within the last six or seven years the Gas Light and Coke Company have supplied about 60,000 such heaters on simple hire, and as these are on simple hire, why, if as the author would have it they are so unsatisfactory, have they not been sent back to the Company? Also it must be borne in mind that the public definitely like an incandescent fire.

Mr. C. B. Howarth, of Newcastle, said that the Gas Industry owes a large part of its prestige to its freedom from failure of supply; and any gas engineer would be reluctant to reduce the reliability of his gas appliances by the addition of auxiliary apparatus. The use of an exhaust fan, he remarked, may be satisfactory for a single gas appliance, but if several appliances were connected to the same flue, as Mr. Barker suggests, it would be extremely difficult to maintain the correct air flow through each individual appliance irrespective of the number of appliances in use at one time. As the various air inlets are in different parts of the building, the varying wind pressures at the different points would quickly make the scheme unworkable. Therefore, he is forced to the conclusion that Mr. Barker's suggestions require considerable modification if they are to show any improvement on the methods at present in use in the Gas Industry.

The next speaker, Col. W. M. Carr, said that the costs set out by Mr. Barker could not be regarded as indicative of the position as it applies to this country generally, because there are such enormous variations in charges. In regard to the Wollaston boiler, this is a good boiler, but it will not work well on breeze, and it requires a large amount of labour and very much closer attention in practice than a solid fuel fired boiler of another type. As to gas applied to central heating, he is able to supply gas for approved loads for this purpose at a price as low as 3½d. a therm; and he gave the meeting full particulars of how, by substituting gas for coke for the central heating of a school, he not only reduced the cost of fuel, but gave a very much more uniform and a very much more efficient form of automatic heating, apart from the great gain in cleanliness, the saving in labour, and the elimination of the necessity for storing solid fuel.

Mr. C. S. Shapley had intended to speak, but time prevented this. He did, however, seize the opportunity of mentioning that he held in his hand a report by Mr. Barker to the City of Leeds. "It was," he said, "on Mr. Barker's advice that we installed gas in Leeds City Buildings. I hope he has not wrongly advised Leeds, and that he will stand by his report."

New Officers.

The Secretary announced at this stage that the following had been elected:

President.—Mr. Frank P. Tarratt (Newcastle and Gateshead Gas Company).

Junior Vice-President.—Lieut.-Col. W. M. Carr (Stretford and District Gas Board).

Auditors.—Mr. H. D. Madden and Mr. Alfred Morland.

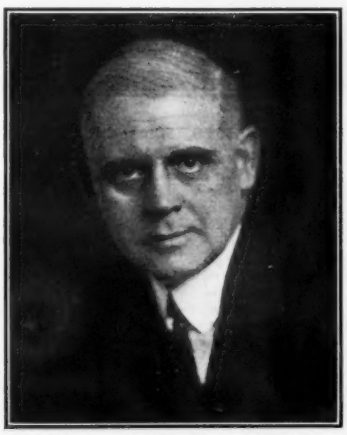
Hon. Secretary.—Mr. W. E. Price. [It was at the 1914 meeting of the Institution at Liverpool that Mr. Price was first elected Hon. Secretary.]

Ordinary Members of Council (1933-36).—Mr. Ralph Halkett (Sheffield), Mr. Robert Robertson (Bristol), Mr. W. J. Smith (Bolton), and Mr. E. B. Tomlinson (Birmingham).

SOME OF THE INSTITUTION
NEW MEMBERS

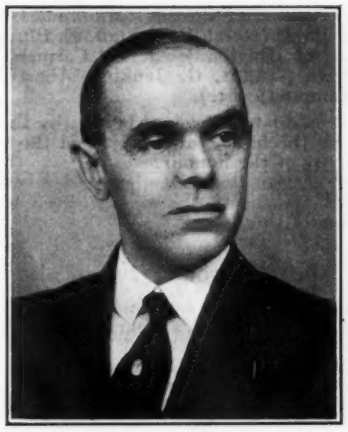
A. G. BIRD, A.M.I.Mech.E.

Mr. A. G. Bird was educated at Northampton Grammar School and the Manchester School of Technology. From 1906 he was a pupil to the late John West, M.Inst.C.E., M.I.Mech.E. Since the war he has been well-known in the Midlands and London area in connection with West's Gas Improvement Company's many activities, while in 1931 he took over Messrs. West's London Office as Representative and Engineer.



FRANKLIN THORP.

Mr. Franklin Thorp is the son of the late Thomas Thorp, of Whitefield, who was well known in the scientific world as an experimenter in physics and in the Gas Industry for his many inventions, particularly in connection with the original prepayment gas meter. Mr. F. Thorp was born in 1876, and educated at the Manchester Central Higher Grade School and then at the Manchester Technical School. At the age of 18 he was apprenticed to a London scientific instrument firm, and while there made some of the instruments used by Prof Dewar in his experiments on liquid air, and for Sir William Ramsey in connection with his discovery of Argon and Helium. At 21 he became a Director of Messrs. Thomas Thorp & Co., Ltd., gas apparatus manufacturers, and is still the Chairman of that Company. For eleven years he was associated as Director with all the Companies comprising the Parkinson & Cowan interests, and besides making two journeys round the world for them, he has, on his own account, visited both North and South America on several occasions. For over 25 years he was a Director of the Rotary Meter Company and also of the Textile Illuminating Company. In connection with this latter Company he made two visits to India. He was one of the early members of the Manchester Junior Gas Association, being President in 1910, and he is now one of the few Hon. Members of that Association.



DAVID MORTON.

Mr. David Morton, Engineer and Manager of the Arbroath Gas Department, was educated at West Public School, Kirkcaldy, and subsequently studied engineering, gas manufacture, and gas supply at the Heriot Watt College, Edinburgh.

CHARLES JOHNSON.

Mr. Charles Johnson, who is Technical Assistant at the Old Kent Road Works of the South Metropolitan Gas Company, received his early training as a pupil of Messrs. West's Gas Improvement Company, Ltd., Manchester, and was subsequently a member of their outdoor constructional and technical staff.

EDWARD A. DAVIES.

Mr. Edward A. Davies received his technical training at the works of which he is now the Manager—namely, the Bradford Road Works of the Manchester Corporation Gas Department—and also at the Manchester College of Technology. He entered the service of the Manchester Corporation in 1902.

District Members of Council.—Messrs. P. D. Walmsley, Great Yarmouth (Eastern Counties); J. L. Hyslop, Belfast (Irish); G. Dixon, Nottingham (Manchester); T. H. Poulson, Stafford (Midland); Lewis Bain, Cullen, Banff (North British); J. E. Blundell, Carlisle (North of England); J. H. Cornish, Bridgwater (Southern); and I. G. Jenkins, Abertillery (Wales and Monmouthshire).

Mr. Tarratt said how honoured he was by the confidence, as indicated by the ballot, and expressed the hope that he would be worthy of the honour.

The names of the Hon. Members, Members, Associate Members, and Associates who were elected will be found on a later page of this issue.

Progress of the Benevolent Fund.

At the conclusion of the business of the General Meeting on the Wednesday morning, a General Meeting of the contributors to the Benevolent Fund was held, Mr. Gibson presiding. An unfortunate feature of the meeting was the very small number who attended it—a point which was emphasized by Mr. C. F. Botley in proposing a vote of thanks to the Committee for the work that they had done during the year. Moving the adoption of the report of the Committee of Management for the year 1932 to 1933 and the Accounts for the year 1932, Mr. Gibson appealed for greater support of the Fund, mentioning that to-day the number of contributors is only about half the total membership of the Institution. Mr. J. R. Bradshaw and Mr. T. Carmichael were elected as members of the Committee of Management for the period 1933-36. A full report of the meeting appears on another page of this issue.

The Gas Grid in Belgium.

Thursday morning's session opened by presentation and discussion of the paper by Mr. George Evetts on "Centralized Manufacture and Distribution of Gas in Belgium." The paper deals with a coke oven plant functioning purely as a gas-works, and erected to replace existing gas-works. The works described is that of the Cokeries du Brabant, a Subsidiary Company of the Imperial Continental Gas Association, at Pont Brûlé, near Brussels; and as Consulting Engineer to the Association, the author has been associated with the scheme almost since its inception. The Cokeries du Brabant is one of five coke oven supplies delivering into a grid, and is the only one built specifically for the purpose of gas supply. The plant, with a daily output of 17·7 million c.ft. of gas (477 B.Th.U. per c.ft. minimum calorific value), consists of a battery of S.O.C. "simple" ovens (capacity 1100 to 1150 tons of coal a day) erected by Successors to the Otto Coke Oven Company, and a battery of Collin compound ovens (capacity 1250 to 1300 tons) erected by Gas Chambers and Coke Ovens, Ltd. The grid stretches practically from the Dutch frontier in the North to the French frontier in the South. The length of the pipeline is 73 miles, and the total length, including main branches, over 100 miles. During 1932 the grid sold 8510 million c.ft. (85 million c.ft. per mile of main, compared with the Ruhr scheme of 49 million c.ft. per mile). The grid is operated by Distrigaz, a Company of which the capital is held by the three chief consumers which it supplies. Companies associated with these consumers also produce the bulk of the gas supplied.

Mr. Evetts points out that the success of the grid scheme as such would not have been affected by any form of gas-works, and the coke oven scheme was adopted because of the favourable geographical position, the scarcity of metallurgical coke at that time in Belgium, and the consequential good selling price, with the prospect of this continuing. At the time, the import of metallurgical coke was 2 million tons per year. In addition, it was found that graded metallurgical coke was a perfectly suitable fuel for the domestic consumer. The closed stove is the method of house heating on the Continent, and since this works has been in operation there has been no difficulty in satisfying all domestic customers with one of the grades of metallurgical coke supplied. Further, the tentative prices obtained and the estimates prepared showed that, viewed as a gas-works, the coke oven was economic in both capital cost and cost of production.

The author also points out that, in considering the operation of a coke oven functioning as a gas-works, there are two fundamental changes produced by the substitution of gas for coke as the principal product. In costing, for instance, the unit is the cubic foot or therm of gas, and all costs must ultimately be reduced to this basis, with the result that the economic basis of the coke oven in general gets a severe twist. Further, the actual process must be re-oriented and the coke oven becomes a gas-works in the strictest sense of the word—that is to say, the carbonizing and bye-product system must be adjusted to suit the production of gas and not the production of coke. The choice of coals is also viewed from a different angle. At the same time, although not of the same importance as in the coke oven, the production of good coke is vital to the economic success of the operation as a whole, because, as in the ordinary gas-works, the price of coke and the ability to sell it are keys to the price of gas.

Advantages of the Compound Oven.

Considering the advantages of the coke oven generally as a gas-making unit, Mr. Evetts puts forward the following: (1) Relatively low capital expenditure; the cost of the complete works at Pont Brûlé was exceedingly low. (2) Freedom of choice of coals. (3) Low labour costs—competitive with any form of gas manufacture. (4) Good technical results when reduced to the cost per unit of gas produced. (5) Most important of all, flexibility—*i.e.*, compound ovens in conjunction with producer gas.

The compound oven has the advantage that it can, with very little change in efficiency, be heated with producer gas of, say, 120 B.Th.U., increasing in quality up to coal gas made in the ovens after having been washed for benzole and of a quality of about 510 B.Th.U. Also, any combination of these two can be employed, and the gas sent out on to the district is of uniform quality hour by hour and day by day, with a considerable margin in the potential coke output.

GEORGE EVETTS, M.Inst.C.E., M.Cons.E.

Mr. George Evetts received his early engineering training at Mason University College and the University of Birmingham; the City Engineer's Department of the Corporations of Birmingham and Westminster for three years; and as draughtsman and technical assistant to the late Mr. H. E. Jones, M.Inst.C.E., and Mr. Frank H. Jones, M.Inst.C.E. Mr. Evetts commenced in private practice in 1919, and is at present Consulting Engineer to the following gas undertakings: Watford and St. Albans, Eastbourne, Romford, Tendring Hundred, Imperial Continental, Bombay, and Oriental, while he has been engaged by many companies and local authorities from time to time in connection with constructional, administrative, and Parliamentary matters.

Figures given by Mr. Evetts show how, in the plant described, the maximum output of gas (21·8 million c.ft. per day) can be achieved with a maximum output of 1583 tons of coke and a minimum of 1356 tons, and this is with only one battery of compound ovens, giving a little over one-half of the throughput. The simple oven comprising the other battery can, with a very slight reduction in efficiency, be heated with a gas broken down by producer gas and equal to blue water gas in heating value. If both the batteries were compound, the maximum coke yield would be 1583 tons per day and the minimum 1075 tons per day, which is a variation of nearly 50% on the smaller figure.

The paper is a complete story of a highly efficient and interesting scheme. The plant is working most satisfactorily.

Advantages of Ovens.

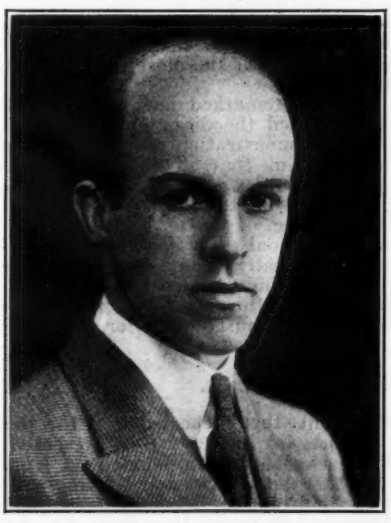
In the discussion, Mr. Arthur H. Lymn—the chief party concerned in Gas Chambers and Coke Ovens, Ltd., who carried out the largest contract in the undertaking—reminded the author that not only coke ovens, but chambers and horizontal retorts, are capable of using cheap coals.

The author had spoken of the blending plant usually associated with coke ovens as leading largely to this result. But, said Mr. Lymn, surely blending plant should be usually associated with every kind of carbonizing plant. Again, the author suggests that the therms per ton cannot be equal to those produced by other well-known methods of carbonizing. We can approximate to the same results in coke ovens as in any other form of carbonizing plant, however, by merely using steam in the coke ovens. That, he said, is not new to-day. There is a plant in the Ruhr which is coking 2000 tons per day and has been using steaming for a long time. Then Mr. Evetts had stressed the flexibility of coke oven plant, as though indicating that the coke oven plant is very special in that direction. Mr. Lymn does not agree, and asks us to envisage the application of the compound system to other types of carbonizing plant. With regard to the indirect ammonia recovery, he suggested that the origin of this was that the plant would be able to make other products if the subject of ammonia market " went west." In Belgium they are getting £7 10s. a ton for sulphate and paying about 30s. a ton for sulphuric acid, and they are making sulphate of ammonia at a profit.

Mr. Evetts agreed that sulphate of ammonia manufacture is a profitable business in Belgium, and that it was with the idea that they could ring the changes in regard to ammonia products that the particular type of recovery plant was adopted. On the other hand, though, of course, he agreed that the use of cheap coals is not necessarily associated with coke ovens, in the paper he drew attention to advantages which are not confined to coke ovens, but are nevertheless advantages of coke ovens. Coal blending is not applicable only to coke oven practice, but hitherto gas-works have not considered blending as an essential part of the process. Coke ovens have invariably included a blending plant.

Flexibility of coke output when operating the works to a fixed gas output is not necessarily a prerogative of coke ovens; but he emphasized that this flexibility is associated with an absolutely fixed gas analysis—the big attraction of compound heating. This form of heating might be extended to other forms of carbonizing plant, but is not in fact.

Other speakers in the discussion asked the author several questions on his distribution practice. Mr. F. H. Robinson, of Harrogate, spoke of condensation in high-pressure systems, and the need for providing syphons. On this matter Mr. Evetts observed that his usual experience is that, at any rate for the first two or three syphons, there is quite a lot of moisture, whatever the degree to which the compression may be carried, whether it is light or heavy; but the amount of moisture tails off after the first two or three syphons. In the particular pipeline with which he deals in his paper, however, the condensation has been less than he has hitherto experienced; and there is practically no difficulty even at the " sinkers " where the pipeline goes under water courses, though syphons are installed in case moisture collects at those points.



JOSEPH E. WHITE.

Sales to Industry.

The last paper to be presented was by Mr. J. E. White, on the development of gas as an industrial fuel; and it is a most encouraging account of what can be done to extend the use of gas in Industry, given an efficient sales organization and scientific rate structures. The Gas Industry's success or failure to establish its product universally will depend on the handling of three vitally important features: Staff organization in individual undertakings and co-operation with other undertakings locally and nationally; charges for gas; and knowledge of the application of gas to industries. To sell gas successfully to industrial consumers, says Mr. White, it is necessary to establish as close a personal contact as possible between an individual who, to the consumer, *is* the Gas Undertaking and the consumer or whoever represents him. For this reason the " one man one district " method has been adopted in Newcastle.

The area of the Newcastle Company is divided into three districts, each with one official in charge and an assistant; all are mechanical engineers. The engineers in charge are responsible to the chief of the department, who in turn is responsible to the commercial manager. The assistant deals principally with the commercial consumers, as these are most numerous and their requirements need less technical knowledge. This leaves the senior man freer to deal with the larger and more unusual type of industrial business. In large undertakings it is in some cases necessary to have speciality men—for instance, for fish frying and central heating—the number depending upon the size of the undertaking and the trades of the area. Each consumer, however unimportant, is called upon at least once a year.

A room has been equipped for the demonstration of furnaces suitable for the industries of the area; but the author states that the utility of this has not been as great as expected. It has become increasingly apparent that consumers in the Newcastle district prefer experimental work to be done under their own direction and in circumstances as nearly approaching normal working conditions as is possible.

Mr. White relates how the Newcastle Gas Company, two years ago, formed a Northern Industrial Centre, and he gives the costs of its working since its formation. These costs are illuminating, and show to what extent the sub-

THE NEW PRESIDENT.

F. P. TARRATT, M.Inst.C.E.

Mr. F. P. Tarratt was trained under the late Alfred Colson, M.Inst.C.E., at Leicester, and appointed Engineer and Manager of the Gas Department at Darlington in 1898, taking up the position of Chief Engineer with the Newcastle-upon-Tyne and Gateshead Gas Company in 1921. During the period he has been with this Company they have taken over the Walker & Wallsend, the Chester-le-Street, and the Tynemouth Undertakings. He holds various official positions in connection with the National Joint Industrial Council for the Gas Industry, the Federation of Gas Employers, the National Gas Council, and the North of England Gas Managers' Association.

scribing undertakings are indebted to the broad co-operative policy and enterprise of the Newcastle Company. This co-operation is bound to achieve remarkable results. As the author says, it would be difficult to imagine a gas undertaking which does not possess an actual or potential commercial or industrial load; in fact, it would be impossible to visualize an area of supply in which no prepared foods are made for re-sale, in which no vessel, other than a domestic vessel, is heated, or in which no wheel is rotated by other than human effort. Each and all are potential consumers, and are worthy of consideration. From the butcher who, through one service pipe and through one meter, consumes for boiling as much gas annually as a row of six houses having six service pipes and six meters, to the steel works taking one hundred million cubic feet per annum, all are worth seeking.

The Flat-Rate Must Go.

But the industrial business will not be gained by a flat-rate tariff. The true development of industrial gas in the Newcastle area dates from the introduction at the end of 1929 of a two-part tariff system. The results of this tariff have been wholly satisfactory. Mr. White mentions, for instance, that one consumer whose consumption had dropped by over 45 million c.ft. during the two previous years, expressed his willingness to reconsider gas on a heat-treatment plant, which, with three exceptions, had been changed over entirely to fuel oil. Within a year the entire plant had been regained for gas and serious consideration given to the possibilities of discontinuing the use of all other fuels in other parts of the works. No industrial appliance using gas has been lost to a competitor since the two-part tariff was introduced.

A section of Mr. White's contribution is devoted to recent developments on the North East Coast. In regard to heat-treatment, he states that atmosphere control alone, made possible by gas, can justify a difference of 3d. a therm in fuel cost. It is being more and more appreciated that what counts is "final cost." Oxy-coal gas cutting, carburizing, heavy forging, re-heating furnaces, and steam raising are among the applications dealt with in the paper; and it is shown that town gas can compete with producer gas made from coal costing 14s. a ton—though admittedly town gas at 2·475d. a therm is the reason.

Most interesting is the author's account of the progress of experimental work on the use of compressed gas as a fuel for motor vehicles. In collaboration with the Northern General Transport Company, the Newcastle Industrial Department has almost solved the difficulties of using gas as a fuel for a high-speed 'bus engine—an engine which works at 3000 r.p.m. So much valuable information has been obtained that the conclusion is drawn that it will eventually be possible for gas to equal petrol performance on any type of engine. The taxation basis created in the last Budget for gas driven vehicles has given an enormous impetus to this venture. For example, to the Northern Company, whose vehicles average 30,000 'bus miles per annum, the cost of the extra taxation is only 0·16d. per 'bus mile for their standard 37-seater vehicles. This figure is equal to 1·12d. per gallon. Thus the total cost per gallon equivalent after all compression and taxation charges have been taken into consideration should not exceed 9·455d. if gas be offered at 4d. per therm. This figure shows a direct saving to the Transport Company of no less than £8700 per annum for each group of 60 vehicles in service; the Company in question operates just over 300 vehicles.

THE SENIOR VICE-PRESIDENT.

C. VALON BENNETT.

A son and brother of living Gas Engineers, Mr. Bennett is a grandson of Mr. W. H. Bennett, who was for many years Secretary to the Incorporated Gas Institute. He trained at the works of the Herne Bay Gas and Coke Company, and was subsequently appointed Assistant Engineer and Manager to that Undertaking. In 1910 he became Assistant Engineer and Manager of the Dartford Gas Company, which Undertaking later amalgamated with the South Suburban Gas Company. In 1913 Mr. Bennett was selected from a large number of applicants for the post of Engineer to the Rochester, Chatham, and Gillingham Gas Company. In 1918 he was appointed General Manager, and in October of that year became Secretary; and he now occupies the three positions. Great extensions and developments have been carried out at Rochester since 1913. The make of gas in 1912 was 573 million c.ft., while by 1931 it had risen to 1057 millions. During a part of the war period Mr. Bennett served as a Commissioned Officer in the Royal West Kent Regiment. He was President of the Southern Association of Gas Engineers and Managers in 1928, and is a Member of Committee of the British Commercial Gas Association, the National Gas Council, and the Federation of Gas Employers.

Need for Personal Contact.

It was appropriate that Dr. C. M. Walter, of Birmingham, should open the discussion on Mr. White's paper, and appropriate, too, that he should pay tribute to the Newcastle Undertaking, which has, in no selfish manner, and under most difficult conditions of trade, set out to develop the industrial business not only in its own area of supply but also in such a manner as to give assistance to other undertakings at very reasonable rates. Mr. H. D. Madden, who appealed to the whole Industry to rally round the Development Centres, also said how greatly the Industry is indebted to the pioneer work of Newcastle and Birmingham; and he expressed complete agreement with the author's statement that industrial salesmen must have a thorough mechanical training. Another point made by Mr. Madden is that the "gas unit" makes good sales talk when in competition with electricity, for it enables the potential consumer of gas to visualize the low cost of heat in the gaseous form. A strong plea for extended standardization was made by Mr. C. Le Maistre, Director and Secretary of the British Standards Association, who said he looked upon the Gas Industry as the most progressive industry in the country.

Col. W. M. Carr remarked how glad he was that Mr. White had mentioned the disappointing results of an industrial furnace demonstration room, because many have been inclined to think that all that was necessary to sell industrial gas was to get a room, put a few standard furnaces into it, and to invite some industrialist to see them. He would never come, of course, but we sat fondly hoping that he might. The only way in which we are going to develop the sale of industrial gas is by establishing that personal service to the industrialist which will secure for us the business; and on this point the paper gives a useful lesson and one which must not be forgotten.

Concluding Proceedings.

The President then reported that the Research and Education Reports for 1932-33 will be presented at the 5th Autumn Research Meeting in London on Nov. 7 and 8, 1933; that the 71st Annual General Meeting will be held on June 5-8, 1934; and that the Second International Gas Conference will be held in Zurich from Sept. 4 to Sept. 7, 1934.

Mr. Thomas Glover, C.B.E. (Past President), moved an omnibus vote of thanks to all who contributed to the success of the meeting. The vote was seconded by Mr. R. G. Shadbolt (Past-President).

The final item of the meeting was presentation of the Presidential Certificate to Mr. Gibson. This was made by Mr. Tarratt, who expressed thanks to Mr. Gibson for his work during his year of office and for his conduct of the meeting. The response of Mr. Gibson, who said that his year of office had been a most happy one, brought the meeting to a close.

A CENTURY OF PROGRESS

Opening of the International Exposition at Chicago

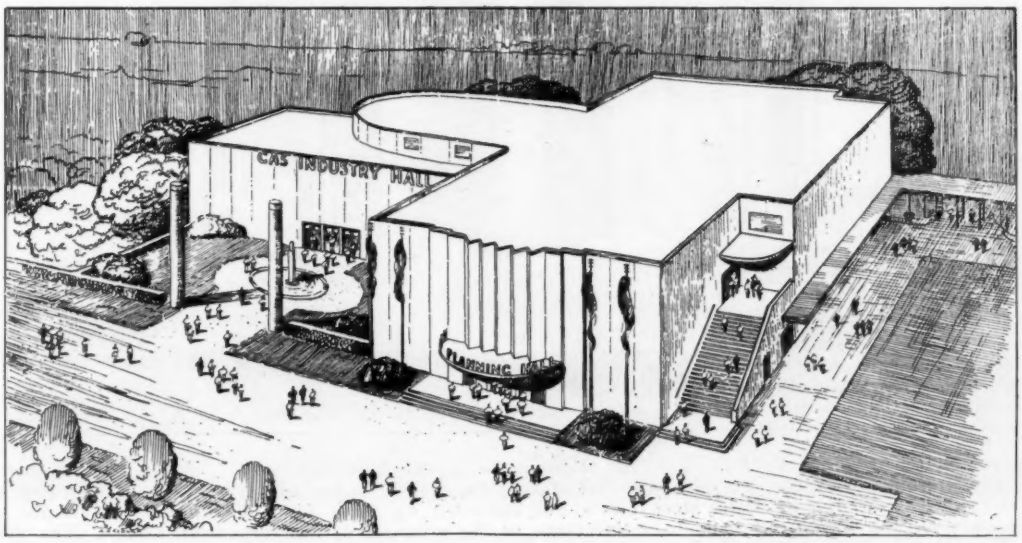
"The Chicago 'Century of Progress Exposition,' the second world fair to be held in the city, opened yesterday with the booming of cannon, the bursting of bombs in the air, which showered hundreds of American flags on 25,000 spectators, and four hours of pageantry, music, and speech-making. . . . At 9.15 in the evening there was an impressive moment, when the power of a beam of light which had started 40 years ago from the star Arcturus was caught by astronomers and in augmented volume transmitted to the Hall of Science, where it started a mechanism which instantly flooded with light all the grounds, waterways, and buildings of the fair." With these words the New York correspondent of *The Times* began his description, on May 28, of the opening ceremony of the great Exposition by which Chicago is celebrating the 100 years of its corporate existence.

Five years ago the project took shape, and perseverance with the scheme through the intervening years of world depression is as significant as the completed Exposition itself. This perseverance is, indeed, as great a proof of faith and determination as that provided by Chicago's century of corporate existence. The Exposition itself occupies 424 acres of lake front within walking distance of the centre of the city. On one side of it, for a distance of nearly 3 miles, are the waters of Lake Michigan. In fact, the grounds are in an area over which only a few years ago rolled 25 ft. of water. From the "Official Book of the Fair," we learn that, "as is customary in anniversary celebrations, the carnival spirit will prevail, but in addition to the fun there will be serious contemplation of the past, and sober consideration of the future."

The Exposition is to remain open until November, and in view of the visit of the Institution of Gas Engineers to the United States which is being planned for September-October next, when four days are to be spent in Chicago, some particulars and photographs (which friends in America have kindly placed at our disposal) will be of special interest.

Lincoln's Log Cabin and Model Gas Home Depict Old and Ultra Modern at Chicago Fair.

Situated within a stone's throw of each other is a replica of Lincoln's log cabin home at Hodgenville, Kentucky, and the latest achievement in private dwelling construction—

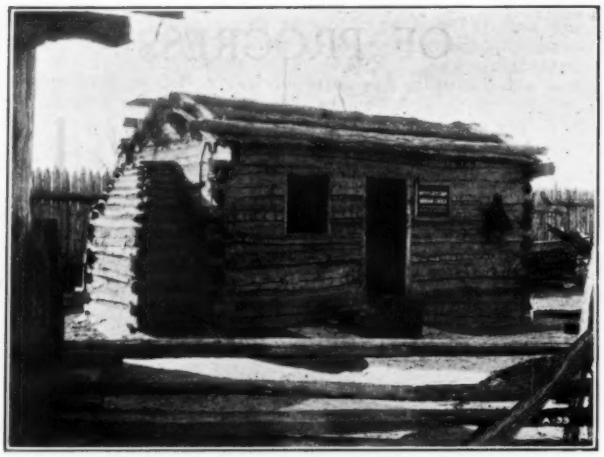


WHERE THE GAS INDUSTRY BECKONS FAIR VISITORS

HERE is shown the architect's rendering of Home Planning Hall, the exhibit centre-piece of the Home and Industrial Arts Group. This large building faces Leif Eriksen Drive, the Exposition's main thoroughfare, and provides 47,200 feet of exhibit space. A south annex to the building is called Gas Industry Hall.

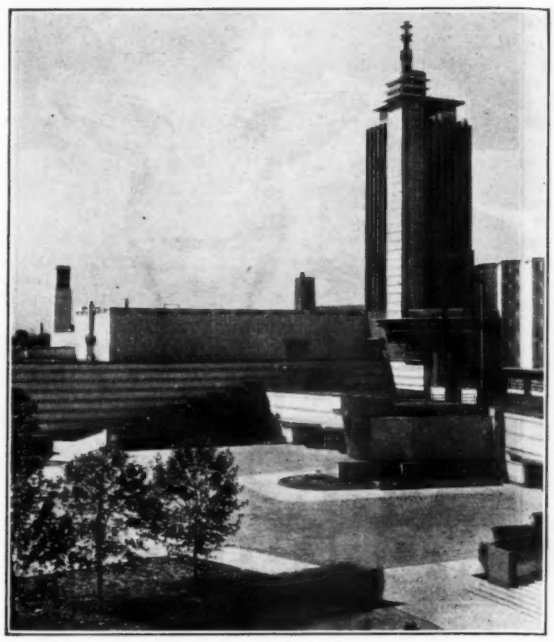
the Masonite gas-serviced model home. These two structures vividly depict by comparison the tremendous advances in home comfort realized in the last hundred years.

The hand-hewn timbers and logs in the Lincoln single-room cabin are more than a century old. The ultra modern Masonite home utilizes a tough wood fibre insulating board, pre-fabricated, and ready for assembly on the spot. The windows are of double glass, with a chemically-



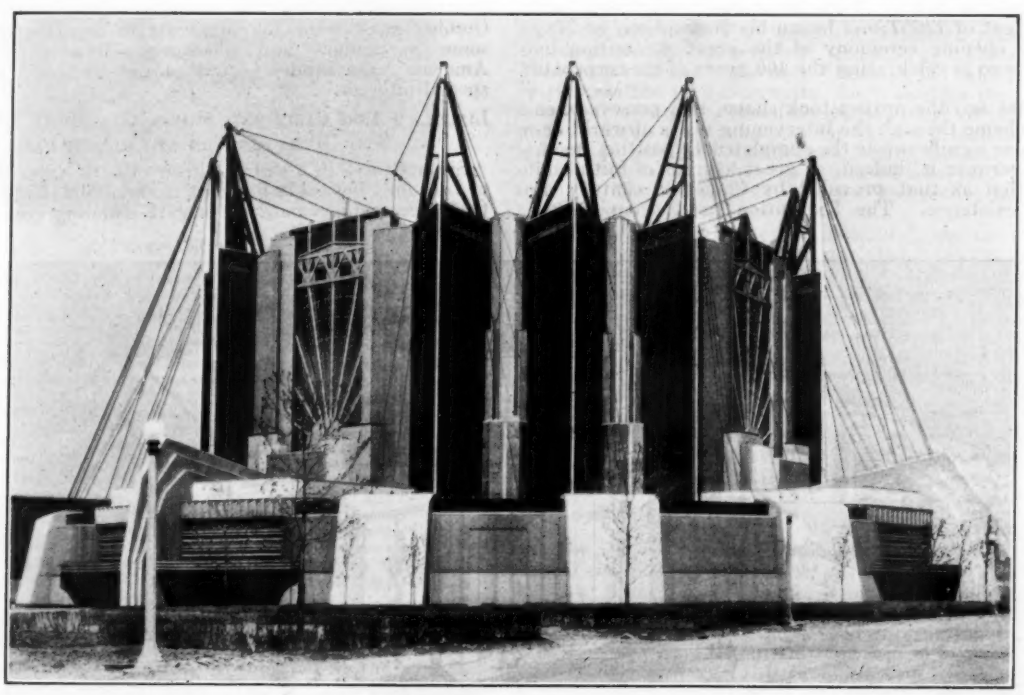
Replica of Abraham Lincoln's birthplace in Hodgenville, Ky. The logs and timbers in this cabin are more than a century old.

treated space in between that eliminates frosting of moisture due to condensation. Both windows and building materials make for ideal conditions for demonstrating the possibilities of gas air-conditioning. There are four rooms in the home, with a solarium opening on to the roof. The garage is an integral part of the structure and is equipped with automatically controlled doors. The bathroom is finished in glazed tile-treated board. Every heating operation relies upon gas service and the most modern gas-using equipment. Gas heats the water, makes ice cubes, cooks the meals, burns the rubbish, dries the laundry, and maintains a pre-determined temperature by wafting clean heated or cooled air through the several rooms.

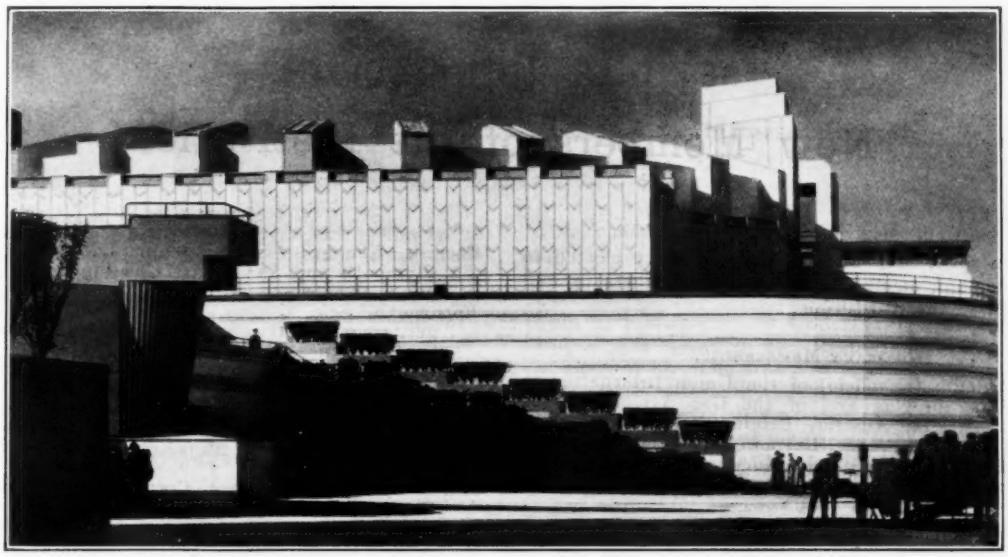


View of the Hall of Science, showing the interior of the great courtyard, the fins for illuminating the tower, and the patterned cut-outs for lighting the wall surfaces.

The range is all-enamel, automatically lighted, with elbow-room cooking top, and insulated ovens equipped with heat control. The refrigerator is of the latest air-cooled type. The front wheel of the air-conditioning unit is re-



Larger than the dome of St. Peter's or the Washington Capitol, this "sky-hung" dome of the Travel and Transport Building strikes a new note in architecture. The roof is formed of metal plates suspended by steel cables hung from a circle of twelve steel towers, and anchored by huge slabs of concrete. It is the first application on any significant scale to architecture of the principle of the suspension bridge. The Travel and Transport Dome is 125 ft. high and 200 ft. across, without a single arch, pillar, beam, or other support to break its expanse. It is said to be the largest unobstructed area to be enclosed beneath a roof. Expansion joints permit the plates which form the roof to slide over each other, as changes in temperature, wind velocity, rain, or snow load cause differences of as much as 6 ft. in the circumference.



SIDE VIEW OF THE HALL OF SCIENCE.

placed by glass, so that the inner workings of the unit may be seen. Other gas-using appliances represent the latest innovations in their respective classes.

In the immediate neighbourhood of the Masonite all-gas home are eight additional model homes, in seven of which gas service is featured in one or more of its most important domestic uses. Every home in the group has been designed to meet the requirements of families of modest means, and to demonstrate that highly attractive living quarters can now be secured at costs lower than ever before. No housing project like it has been attempted before in the United States.

Big Share of the Gas Industry.

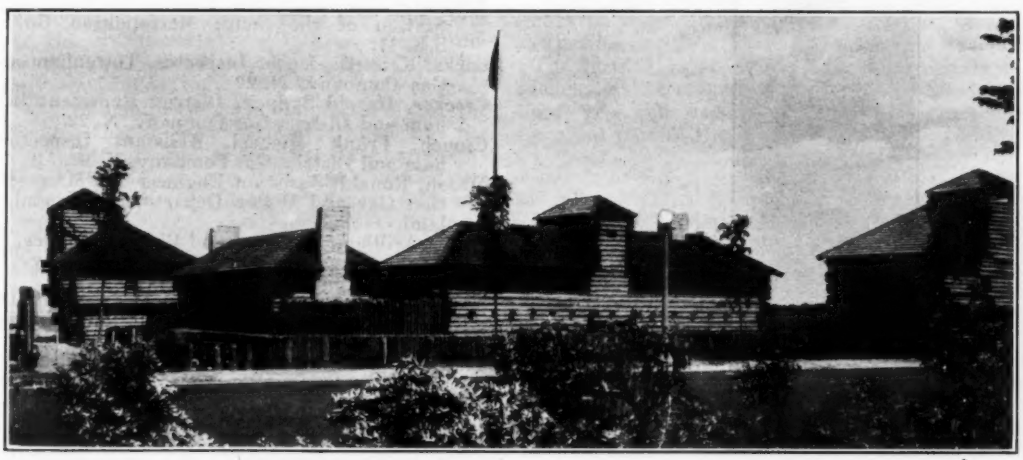
As will be gathered from what is said here, the participation of the Gas Industry in this great industrial show will be an important and diversified one. Before the Fair opened, there were 26,150 ft. of gas main laid, consisting of 1500 ft. of 12-in., 5300 ft. of 10-in., 1250 ft. of 6-in., 14,600 ft. of 4-in., 2000 ft. of 3-in., and 1500 ft. of 2-in. All mains are of standard steel, coated, and Dressler couplings are used throughout. In addition to the above, 3000 ft. of old 12-in. main that brings in the gas to the fair grounds proper has been leak-clamped.

The gas supply comes from a 30-in. medium-pressure line, graduated down to where 1-in. to 3-in. services enter the buildings. The main-laying work made it necessary to tunnel under the Illinois Central tracks and to cut through an old breakwater of rock and install a 6-in. main under the bridge connecting the mainland with Northerly Island.

In all probability, the chief point of attraction for members of the Gas Industry will be that portion of the grounds known as the Home and Industrial Arts Group. Dominating this group is Home Planning Hall, a building fronting on Leif Eriksen Drive, the Exposition's main thoroughfare, and providing 47,200 ft. of exhibit space. A south annex to the building is called Gas Industry Hall.

Developments in heating, plumbing, air-conditioning, and household equipment and appliances are featured in the building as a whole. There is an exhibit by the American Gas Association and individual displays sponsored by well-known firms. Adjoining Home Planning Hall are the nine model homes already referred to.

The official poster for Chicago's 1933 World's Fair beckons the world to come and see her Century of Progress Exposition. She is the Miss Chicago the world has known since the famous World's Fair of 1893. The familiar Phœnix on her head blazons the city's motto, "I Will." The Indian head in the background recalls the Chicago of 1833, a little village in the Red Man's wilderness.



Blockhouses and soldiers' barracks of the "third Fort Dearborn," reappear on the shore of Lake Michigan as part of A Century of Progress Exposition—Chicago's 1933 World's Fair. Built according to the specifications for the original fort, whose inhabitants were victims of the Dearborn Massacre in 1812, this quaint log-built stronghold has already become a magnet for thousands of visitors.

New Members of the Institution

On Wednesday, May 31, the following were elected to hon. membership, membership, associate membership, and associateship of the Institution:

Honorary Membership.

The Presidents (*ex-officio*) of the Union Internationale de l'Industrie du Gaz and of the Gas Associations of America, Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, France, Germany, Holland, Hungary, Italy, Japan, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, and Yugoslavia.

Membership.

Bird, Arthur George, London Representative and Engineer, West's Gas Improvement Company, Ltd., 89, Kingsway, W.C. 2.

Clayton, Robert Henry, B.Sc., Director, Manchester Oxide Company, Ltd., Miles Platting, Manchester.

Davies, Edward Arthur, Works Manager, Bradford Road Works, Corporation Gas Department, Manchester.

Johnson, Charles, *Institution Diplomé in Gas Engineering, 1st Class*, 1932. Technical Assistant, South Metropolitan Gas Company, 709, Old Kent Road, S.E. 15.

Morton, David, Engineer and Manager, Corporation Gas Department, Arbroath, Angus.

Symonds, Edward Samuel, B.Sc. (Eng.), Engineer, Imperial Continental Gas Association, 2, Devonshire Square, E.C. 2.

Thorp, Franklin, Technical Director, United Gas Industries, Ltd., 51, Lincoln's Inn Fields, W.C. 2.

Warr, Raymond George, Engineer, Adderley Works, Corporation Gas Department, Birmingham.

Associate Membership.

Allen, Albert, Manager, Droylsden Works, Corporation Gas Department, Manchester.

Bentley, Samuel Cowell, Draughtsman and Clerk of Works, Corporation Gas Department, Leicester.

Bolland, Clifford Beaumont, M.Sc., Research Chemist, South Yorkshire Chemical Works, Ltd., Rotherham, Yorkshire.

Butcher, Thomas Parker, Technical Assistant, Corporation Gas Department, Burnley, Lancashire.

It was recalled at the Meeting that Mr. W. E. Price was first elected Hon. Secretary on the last occasion that the Institution met in Liverpool—1914. His re-election this year means that he has held the position without a break since that time.

Cornish, Kenneth Charles, Senior Laboratory Assistant, Plymouth and Stonehouse Gas Light and Coke Company, Devonshire.

Farnworth, Eric Newton, Assistant Engineer and Manager, Urban District Council Gas Department, Oswaldtwistle, Lancashire.

Field, Alexander, Technical Assistant, Urban District Council Gas Department, Skipton, Yorkshire.

Field, Eric Basham, First Engineering Assistant, Corporation Gas Department, Blackburn, Lancashire.

Gidlow, Henry Beynon, Assistant Chemist, Liverpool Gas Company.

Harrison, Wilfred, Chemist, Corporation Gas Department, Wigan, Lancashire.

Hubbard, William Samuel, Assistant Works Manager, New Wortley Works, Corporation Gas Department, Leeds.

Johnston, Harry, *Institution Diplomé in Gas Engineering, 1st Class (with distinction)*, 1931. Engineering and Technical Assistant, Corporation Gas Department, Blackpool, Lancashire.

Maycock, Eric John, Assistant Works Superintendent, Corporation Gas Department, Salford, Lancashire.

Penny, Arthur W. F., Chief Works Chemist and Technical Assistant, Barnet District Gas and Water Company, New Barnet, Hertfordshire.

Sidaway, Frederick William, Technical Assistant, Cradley Heath Gas Company, Staffordshire.

Vane, Sydney George, Assistant Chemist, Croydon Gas Company, Surrey.

Walker, Frank, Chemist and Technical Assistant, Uxbridge, Maidenhead, Wycombe, and District Gas Company, Uxbridge, Middlesex.

Ware, Frederick Henry, Works Assistant, Maidstone Gas Company, Kent.

Wicks, Thomas Robson, Chemist and Technical Assistant, Corporation Gas Department, Middlesbrough, Yorkshire.

Wild, Walter, Chief Works Superintendent, Regent Road Works, Corporation Gas Department, Salford, Lancashire.

Associateship.

Allott, Gerald William, General Sales Manager, Ironworks Department, Newton Chambers and Co., Ltd., Thorncliffe, Yorkshire.

Broadhead, Roland Wynn, Chairman and Managing Director, Broadhead Constructions, Ltd., Stretford, Lancashire.

Burton, Alfred Howard, Assistant Engineer and Manager, Corporation Gas Department, Warrington, Lancashire.

Carpenter, Philip Turner, Assistant to Engineer, Vauxhall Station of the South Metropolitan Gas Company, S.E. 11.

Cocks, Kenneth, Depôt Inspector, Tottenham and District Gas Company, N. 22.

Crocker, Harold Sydney, District Representative, Tottenham and District Gas Company, N. 22.

Crouch, Frank Michael, Assistant Inspector, Tottenham and District Gas Company, N. 22.

Mason, Ronald, Assistant Engineer and Manager, Corporation Gas and Water Department, Kendal, Westmorland.

Miller, William, Engineer and Works Manager, Walton-on-Thames and Weybridge Gas Company, Walton-on-Thames, Surrey.

Napper, Alfred Leonard, Technical Assistant, Distributing Engineer's Department, South Suburban Gas Company, Lower Sydenham, S.E. 26.

Plummer, Ronald George B.Sc., Pupil Engineer, Gas Light and Coke Company.

Roberts, Leonard William, Assistant Works Manager, Harrogate Gas Company, Yorkshire.

Swann, Albert James, Assistant Inspector, Gas Light and Coke Company.

Thompson, Allaister James, Assistant Inspector, Gas Light and Coke Company.

Waddell, Marshall Alexander, Engineer and Manager, South Queensferry Gas Company, West Lothian.

Wills, Horace R., Engineer and Manager, Atherstone Gas Light and Coke Company, Ltd., Warwickshire.

Presidential Address

Of RALPH ERNEST GIBSON, M.Inst.C.E., M.Inst.Gas E.,

Chief Engineer, The Liverpool Gas Company.

The great honour you conferred in electing me to be your President a year ago brought with it many onerous duties, not the least of which is that of delivering a Presidential Address—a task which becomes more difficult with each passing year. The fact that the President's Address is almost his last duty does not render it easier, since the Address is prepared during a period of exceptional activity and when his time is fully occupied with numerous official engagements. In some respects, I envy the President who is called upon to deliver his Address at the beginning, rather than at the end, of his year of office.

It is nineteen years since the Institution met in Liverpool. My predecessor as Chief Engineer of the Liverpool Gas Company, the late Mr. Edward Allen, was President, and many here to-day will remember that Meeting. It is interesting to recall it was at that Meeting in 1914 that Mr. W. E. Price was elected Honorary Secretary, an office which he has held continuously to the present time.

It is appropriate that I should review briefly some of the events in the history of the Gas Undertaking of this City.

The Gas Industry in Liverpool.

The connection of Liverpool with the Gas Industry goes back to the year 1815, when one Hargraves came from London with the object of forming a Company to light the Town by Gas. He saw several influential inhabitants, but met with very little encouragement until Mr. Jonathan Varty, a Coach-builder, became interested. Mr. Varty secured a few Subscribers, who exacted from him a promise that he would, in twelve months, return to them their deposit of £3 per share if the Scheme which he formulated proved unsuccessful. The total money raised only amounted to £70 or £80, with which a small gas apparatus was erected at Mr. Varty's premises in Dale Street. Two gas lamps were erected in front of the Town Hall, the light from which was said to have been so brilliant that a person could with ease ascertain the hour by his watch at a distance of twenty or thirty yards.

Such were the small beginnings of the Liverpool Gas Company. Since then the history of the Undertaking has been one of continuous progress, although there have been times of difficulty and misfortune. A serious catastrophe occurred in 1874, when the Liverpool Landing Stage was completely destroyed by a fire, which was attributed to the operations of a gas fitter. Legal proceedings ensued, and, after a hearing of five days, the Gas Company was called upon to pay a large sum of money by way of compensation. In consequence, the Company decided that it would no longer undertake the business of gas fitting, and a separate Company—the Liverpool Gas Fittings Company, Ltd.—was formed and carried on the gas fitting work for 37 years. It was eventually found, however, that the Gas Company's business was being adversely affected and, in 1911, the Liverpool Gas Fittings Company, Ltd., was absorbed by the Liverpool Gas Company. Greatly increased business was the result.

These historical notes would be incomplete without reference to the long association of 86 years of the King family with the Liverpool Gas Company. The name of Joseph King appeared in the Act of 1818, and the position of Engineer was filled by John King in 1824, by Alfred King in 1826, and by his son, William King, from 1867 to 1904 when he retired.

Prior to the year 1914, Liverpool gas was always noted for its high illuminating power, the standard being 20 candles in the flat flame burner. With the advent of the test for calorific value, however, a considerable reduction in quality took place, but without inconvenience to the consumer and with improved efficiency in the gas supply.

The area of supply of the Company has been extended in recent years by the inclusion of the Fazakerley, Hightown, and Woolton Gas Undertakings, and the absorption of the Huyton and Roby Gas Undertaking in January, 1933. The area now stretches along the Mersey side from Speke in the south to Hightown in the north and in an easterly direction as far as Whiston. There are about 1186 miles of mains, serving 215,872 consumers and a population of about a million people.

Progress of the Gas Industry since the War.

Two months after the Annual General Meeting of the Institution in Liverpool in 1914 war was declared—a catastrophe which shook the whole world, and profoundly affected the Gas Industry. We are still suffering from the effects of the Great War and its aftermath, and we shall continue to do so for many years to come.

Nevertheless, since 1914, the Gas Industry has advanced considerably in technical knowledge, in improved methods, and in greatly increased output. The membership of The Institution of Gas Engineers has increased from 875 in 1914 to 1467 in 1933, whilst its prestige and status was recognized by the grant of a Royal Charter in 1929.

When William Murdock first lighted his house at Redruth in 1792 he little dreamed of the extent to which Gas would one day be used. The Gas Industry continues to progress, in spite of the ever-increasing competition of other forms of light, heat, and power and the retention of many of the legal restrictions imposed to meet the conditions of a century ago. The present position can be visualized best by reference to the latest statistics.

The output of gas in the British Isles is nearly 300,000 million cubic feet per annum. The capital invested in Company and Municipally owned Gas Undertakings is approximately £202,000,000. The number of men employed in the Industry is 113,000. The quantity of coal used per annum is 17,427,000 tons. In addition to the Gas made, there are produced 11,732,000 tons of Gas Coke, 212,682,000 gallons of tar, and large quantities of other by-products. There are 51,807 miles of gas mains, whilst Gas and its by-products are used in some form or other by nearly the whole of the population of this country.

New uses for Gas and its by-products are being discovered from time to time as a result of research and experiment. We have by no means reached finality. The Institution of Gas Engineers through its exchange of ideas, its technical discussions, its Education Scheme and research and technical work is playing an important part in the development of the Industry.

The Gas Engineer.

The membership of The Institution of Gas Engineers comprises a large number of men with varied gifts and experiences. In its ranks are included Gas Works Engineers, Distributing Engineers, Chemical Engineers, Industrial Heating Engineers, Civil Engineers, Mechanical Engineers, Constructional Engineers, and the like. All are called upon to face, sooner or later, difficulties due to accidents or unforeseen circumstances; most have experienced mishaps or failures at some time or other; forces of Nature have to be reckoned with. Experiences in abnormal conditions are always valuable. Much can be learned from failures and difficulties; in fact nothing can take the place of experience gained in this way. The trouble is that whilst we are ready to publish our successes, we are reluctant to broadcast our failures for the guidance of others.

The true Engineer is largely dependent on experience

and the proper appreciation and balancing of the available knowledge, much of which is inexact. He is under a great obligation to many others—Chemists, Geologists, Metallurgists, and the like—for the information necessary to carry out his work successfully.

Engineering Contractors are sometimes called upon to suffer through untoward circumstances. The Gas Works Engineer owes a great deal to those who erect gas plant. The Contractors are generally ready to carry out their contracts fully, in both letter and spirit, even if their fulfilment means loss. Such losses are incurred, but fortunately not frequently.

Tenders for any large work of construction are usually invited either by advertisement or from selected firms, the lowest tender being generally accepted under the latter course, which appears to be the best procedure to adopt for several reasons. The Engineer has confidence in the contracting firms selected; low tenders at unremunerative prices are to some extent avoided; these are unsatisfactory in that the Contractor may be tempted to cut his materials and labour to suit the price. Contracts carried out under such conditions are never satisfactory.

Development of the Uses of Gas.

The depressed condition of trade and the vast amount of unemployment have naturally had an adverse effect on the development of gas sales, but the Gas Industry has not suffered to the same extent as the majority of the Industries of the country.

In the Domestic field there is room for expansion, especially as to water heating, central heating, and heating rooms by gas fires. A census of the gas appliances in use in a large City was recently taken. Of the premises visited only two-thirds were provided with gas cookers, and only 8 per cent. with water heaters other than wash coppers. The average number of gas fires per house was only 0·59. If these statistics are representative of other Towns, there is clearly a vast field for further development. Much publicity work remains to be done, particularly by the Gas Undertakings themselves. The times demand greater energy and activity in our sales organization than ever before. If the work is tackled with zeal and enthusiasm, we may look forward to a large expansion in our business.

Development of Gas in America.

Notwithstanding the extensive use of electricity in the United States of America, the rate of increase in Gas output has been far greater than in this country, and Gas has there become the chief fuel for cooking. Our American colleagues have shewn us what can be done to increase sales and a study of their methods would be worth while.

The forthcoming Visit of The Institution of Gas Engineers to Canada and the United States of America will afford an exceptional opportunity to investigate at first hand their sales organization and other aspects of Gas Practice. I am glad to think that many Gas Undertakings have authorized representatives to participate in the Visit, because I am certain that the moderate expenditure involved will be amply repaid.

Gas for Industrial Purposes.

The development of the uses of Gas for Industrial and Commercial purposes has lately received special attention. The Scheme which is now being completed under the auspices of a Joint Co-ordinating Committee of the three Central Gas Organizations will, it is confidently hoped, result in a large increase of business. It is essential, however, that the Scheme should receive the whole-hearted support of every Gas Undertaking in the country, whether situated in an Industrial area or not. More important than the necessary financial support is the co-operation of everyone concerned, and the utilization of the facilities which will be afforded by the establishment of the District Development Centres and the co-ordinating department at Headquarters in London.

This movement is not solely a large scale Industrial Gas Campaign. It is one which embraces the application of Gas for every conceivable purpose for which Gas is suitable, including the requirements of bakeries, catering establishments, and the heating of public buildings. If the opportunity which the Scheme affords is neglected much business may be irretrievably lost.

In developing the use of Gas for Industrial and Commercial purposes, the price at which Gas can be supplied is a very important consideration; in fact, the price is in many cases the deciding factor in the securing of business against competition. The bringing down of manufacturing and distribution costs should be the constant aim of every Gas Engineer and Manager.

The Gas Legislation Committee appointed by the Board of Trade has recently issued its Second and Final Reports. It has made recommendations which, if put into effect, will be useful in arriving at equitable methods of charging for gas for Industrial and other purposes. There are many factors to be taken into account in arriving at these charges, not the least of which is the effect of new business on the hourly, weekly, and yearly load charts. Any additional load which will help to straighten out these charts so as to approach more nearly the ideal should certainly receive special consideration.

Amalgamations.

In the early part of the Nineteenth Century, the use of Gas spread all over the country to meet the needs of the various local communities. Every small town and even some of the villages were provided with Gas Works, which thus became a common institution. A Gas supply, replacing oil lamps, was a boon to the inhabitants of these small places. Many such Works have grown out of all recognition during the last hundred years, but there remains a large number of small, isolated Gas Undertakings, with an annual output of less than fifty million cubic feet of gas. Such Undertakings, with their limited resources, will not find it easy to make progress in the future.

Many have been amalgamated with larger Undertakings, and from the point of view of the welfare of the Gas Industry as a whole, as well as of the Undertakings themselves, it seems well that such amalgamations should continue to be made. Small Undertakings situated at long distances from the nearest large town, may find difficulty in amalgamating with larger Undertakings. In such cases, much might be done by grouping and working them collectively, thus securing savings in manufacture and overhead charges. In the course of time circumstances will bring these changes about. Would it not be wise to anticipate the event and bring the amalgamations about before sheer necessity forces it? By amalgamating with the larger Undertakings or by grouping, the small concerns could more effectively meet competition, and so retain business which otherwise might be irretrievably lost. In this connection it should be remembered that the small Gas Undertaking has to meet competition not from a concern of its own size, but from highly organized, large scale, and State-aided competitors. Other advantages to be derived from the policy to which I have referred are greater efficiency, cheaper raw materials, reduced cost of manufacture, saving on standing charges, more active and intensive salesmanship, and better service to the consumer. In addition, the smaller Undertakings would have the benefit of the greater resources possessed by the larger Undertakings, including the services of highly trained and experienced men.

The Tax on Oil.

The price of Oil has been so low during the last few years that it has gained a strong position as a competitor with gas and other forms of fuel for heating purposes. The view held by the Gas Industry generally is that Oil, being of foreign origin, should be taxed, as it enters to a considerable extent into competition with home-produced materials, such as Gas, Coke, and Creosote, etc. Those who hold this opinion will have been pleased with the action of the Chancellor of the Exchequer in placing an Import Duty of 1d. per gallon on Heavy Hydrocarbon Oils, including Fuel Oil, Gas Oil, Diesel Oil, Lubricating Oil and Kerosene, together with an Excise

Duty of 1d. per gallon on Oil of that nature in stock on the 25th April, 1933.

The imposition of the Tax places a serious financial burden, however, on Undertakings making Carburetted Water Gas. Cheap supplies of Gas Oil have enabled Gas Undertakings to manufacture Carburetted Water Gas at low cost and, at the same time, to dispose of large quantities of surplus coke.

Again, it is not improbable that the price of coal may tend to rise as a result of the increase in the price of Oil. We must also bear in mind that Oil is competing with electricity and the other forms of fuel with which the Gas Industry has to compete. We can only hope that the general effect will be beneficial to our Industry.

The Coal Industry.

Disrupted by labour troubles, the Coal Industry—our parent Industry—has lost much of its export trade and is in a languishing condition. In a desperate effort to gain its former prosperity, it has resorted to various schemes of price control, culmination of which is to be seen in the Coal Mines Act, 1930. The restrictions under that Act have helped the inefficient collieries, but have had a very serious effect on many of the more efficient and up-to-date collieries. The Coal Mines Act of 1932, which came into force on 1st January, 1933, continues the provisions of Part I of the Act of 1930 for a period of five years. Prior to the Act of 1930, Gas Undertakings were able to purchase their requirements in the open market; there was free competition, and the ordinary laws of supply and demand operated. To-day prices are controlled more or less by the collieries themselves. It is singularly unfortunate that an attempt should have been made to compel Public Utility Undertakings to pay increased prices. This short-sighted policy was not calculated to improve our relations with the Coal Industry. If there is any Industry which should be looked upon by the Coal Industry as its ally, surely it is the Gas Industry—one of the greatest users of coal and an Industry which is capable of great expansion. We have the means at our disposal for converting raw coal into readily marketable Smokeless Fuels, gaseous and solid, having high efficiency and yielding valuable by-products. Every ton of Gas Coke sold means the purchase of approximately 2 tons of Coal, while every million cubic feet of gas consumed necessitates the purchase of at least 50 tons of coal.

Coal is our greatest national asset, but the supply is not inexhaustible. We are using up our national resources of coal at a rapid rate. Any processes by which coal can be made to go further, by reason of greater efficiency in use, are worthy of the most careful attention. The gas works process can shew a higher efficiency than any other process for the conversion of coal into heat units. But the conservation of coal is not a popular subject to-day with the Coal Industry, which fears that the efficient gas works process is detrimental to the Coal Trade. This is a short-sighted view. The scientific use of Coal by means of carbonization is bound to extend. Great advantages are gained from the use of gaseous fuel and valuable by-products are recovered. Gas gives more effective heat control, saves transport, reduces wear and tear on the roads and abolishes the smoke nuisance.

We sympathize with our Irish confrères in having to submit to the action of the Irish Free State Government in placing a heavy duty on British coal imported into the Free State. This must be a heavy burden, especially to the smaller Undertakings. Foreign coal will, to some extent, take the place of British coal, and this is a serious matter for the British collieries who have hitherto supplied gas coal in the Irish Free State. We can only hope that the duty will soon be removed.

Coke—the Chief By-Product.

The most valuable by-product from the carbonization of coal is Gas Coke. Unfortunately its sale in this country is still far from satisfactory. Large quantities of coke—probably a million tons per annum—are exported to Scandinavia and other countries at comparatively low prices, when it could be sold at home as smokeless fuel at prices which would be far more remunerative. While much has been done to render gas coke more suitable for the domestic market, there is great scope for further improvement. As ordinarily supplied, Gas Coke is not as popular as it deserves to be. While it is used extensively in closed boilers and heating stoves, it has not made much headway as a fuel for the open domestic grate. This is accounted for, to some extent, by variation in quality, high ash content, too much moisture, difficulty of ignition, or unsuitable size.

Low-Temperature Coke, when made from clean coal of suitable quality, is a satisfactory fuel for the domestic grate, but unfortunately its price has to be fixed comparatively high if the process is to present a paying proposition. High-Temperature Coke, however, can be made which will answer the purpose equally well, if not better, from the point of view of smokelessness, if due regard is paid to the methods of manufacture. By suitable selection and blending of coals, by dry cooling and grading to suitable size, and by taking care to maintain a uniform quality, an excellent fuel can be obtained on the Gas Works. It is inadvisable to call such special fuel "Gas Coke." A name should be given it, which would guarantee its uniformity and excellence of quality. Ease of ignition is an important matter, since many people will not go to the trouble or expense of having special grates installed and fitted with gas burners. If the fuel is to be generally acceptable, it must be capable of being easily ignited and successfully burnt in any ordinary grate.

In correctly grading this smokeless fuel, there will probably be a large increase in the amount of fine breeze produced, for which there is generally some difficulty in finding a market. Producers are now obtainable, however, which will consume breeze in a satisfactory manner for heating the retorts, so that there should be no difficulty in disposing of the excess breeze.

Largely owing to the efforts of the National Smoke Abatement Society, public opinion is gradually being developed in favour of the use of smokeless fuels. We should take advantage of this, and the subject calls for the prompt and united action of the Gas Industry.

Motor Fuel.

The bulk of the enormous quantity of petrol used in this country as motor fuel is of foreign origin. The great petrol supply companies have served the country well, but it is increasingly evident that the matter should be looked at from the National point of view. Home-produced motor fuel should have preference if our country is to rely less upon supplies from abroad. The National Benzole Company has rendered good service to the Nation in general and the Gas Industry in particular by marketing National Benzole Mixture, which is largely a home-made product.

A considerable increase in the production of benzole by stripping coal gas has been a notable feature of the past year.

The developments taking place in the use of bottled gas and of creosote as motor fuels hold great possibilities for the near future. The practical difficulties in using compressed gas seem to have been overcome. Steel cylinders have been produced which are sufficiently strong to withstand the very high pressures required and are not unduly heavy. The results so far obtained seem to be highly satisfactory, and the general adoption of compressed gas, involving the provision of compressing stations, appears to be largely a question of time.

The use of specially prepared Creosote as a motor fuel, which originated in Belfast and has been further developed in other towns, holds much promise of success, and it is hoped that all the initial difficulties will soon be completely overcome. The quantity of this fuel that can be produced is limited as only a small proportion can be extracted from the creosote.

These three alternatives to petrol—benzole, compressed gas, and creosote—should have a very beneficial effect on the Nation's motor fuel supplies. If half the quantity of petrol imported into this country were replaced by the fuels to which I have referred, a very material addition to the resources of the country would

be made, and a substantial amount of much-needed employment would be given.

Hydrogenation.

Another interesting development, which holds great possibilities for the future, is the hydrogenation of coal, tar, and creosote. The process for the hydrogenation of coal, developed by Bergius, has been tried out on a working scale and would be commercially successful on a large scale if the prices now ruling for motor spirit continued. If the tax of 8d. per gallon on petrol were removed, however, the process would become practically unremunerative. The future will thus depend largely on the policy of the Government. The quantity of motor spirit obtainable from 100 tons of coal (including the coal required for raising steam and working the process) is approximately 8000 gallons.

It would appear that the Country's requirements of motor spirit could be met by hydrogenation, in which event there would be a largely increased output of coal and employment for a great number of miners and other workers. Future developments will be watched with the keenest interest by the Gas Industry.

Labour.

Much has been said about the mechanization of industry being the chief cause of unemployment. In the Gas Industry, however, unemployment is not to be seen to any serious extent. This is due to the fact that, whilst not neglecting to use every means of cheapening production by adopting modern methods, we are paying much greater attention to the distribution and service side of the Industry, with the result that the additional men employed for this work have probably more than balanced any reduction in the number of men employed in manufacture.

The continued success of Co-partnership in promoting good relations between employers and employed is a satisfactory feature of many company-owned Undertakings. The ever-increasing holdings of workmen in the Stock of the Companies they serve is a potent factor in binding the men to the Undertakings, and gives them a keener interest in their work and the prosperity of their Industry.

Conclusion.

My year of office as President, although an exacting one, has been fraught with many happy experiences. It has been my privilege to attend many meetings of the District Gas Associations, Junior Gas Associations, and of several kindred Institutions. The general impression I have received is that there are signs of great vitality and keen interest in all that appertains to the welfare of the Gas Industry.

Gentlemen, I much appreciate your kindness and goodwill shewn on many occasions, and which have been a great help during the past twelve months.

The Institution Benevolent Fund

The General Meeting of the contributors to the Benevolent Fund of the Institution was held at St. George's Hall, Liverpool, on Wednesday, May 31, 1933. The PRESIDENT (Mr. Ralph E. Gibson) presided.

The HON. SECRETARY (Mr. J. R. Willis Alexander) read the notice convening the meeting.

The minutes of the preceding general meeting were taken as read and were confirmed and signed.

The PRESIDENT, moving that the report of the Committee of Management for the year 1932-33 and the Accounts for the year 1932, as printed and circulated to contributors, be taken as read and adopted, said: I should like to say that the Committee of the Fund is doing very useful work, and deserves the full support of every member of the Institution. I should like to see a considerable increase in the number of contributors to the Fund, for the number of contributors is only about half the total membership of the Institution, which I consider is not satisfactory. We have spent during the past year £755 10s., as compared with £695 15s. in the previous year, and our expenditure is some £200 more than the amounts subscribed by the members. Had it not been for the donations we should be much on the wrong side; but the donations constitute an uncertain factor, and therefore, it is very desirable that more contributors should support the Fund. I do plead that increased support be given to this very deserving cause.

The motion for the adoption of the report and accounts was seconded by Mr. JOHN TERRACE (Past-President), and was carried.

ELECTION OF MEMBERS OF COMMITTEE OF MANAGEMENT.

The scrutineers' report of the ballot for the election of two Members of the Committee of Management for the period 1933-36 showed that the following had been elected:

Mr. James Robert Bradshaw.
Mr. Thomas Carmichael.

Mr. C. F. BOTLEY (Past-President): You, Mr. President, have to suffer the mortification of previous Presidents in saying that the members have given nothing less than disgraceful attention, and I feel that by reason of the small attendance at this meeting there has not been shown the courtesy due to you in the Chair. The manner in which members go out of the meeting hall while you are on your feet annoys me, and it is very fortunate that I do not occupy your position to-day. I think that more respect should be shown to you; there are only a few faithful people here to support the work of the Benevolent Fund.

I did not rise really to deliver myself of that protest, about which I feel very strongly, but to propose a vote of thanks to the Committee for the work it has done for the Fund during the past year. The members of the Committee have given a very full account of the claims they have dealt with; I do not suppose they purpose always giving them *in extenso*, but they have been very busy and I know they have done very useful work. We are indebted to them; somebody has to carry on the work of the Fund. The members do not seem very much concerned about it, although I am very pleased by the increase in the number of subscribers. I notice also that the value of investments is omitted from the report, and I think that is a favourable sign, for if we wanted to realize investments we should not be out of pocket.

Mr. C. DRU DRURY (Sunderland): It is with real pleasure that I rise to second this vote of thanks, for I think the Institution is very much indebted to the Treasurer and Committee, who have what must be very often a difficult task in allotting this money. It is unfortunate that they have not really enough money to enable them to deal with all the cases that arise. I imagine that only 60% of the members of the Institution are subscribers; if the other 40% would subscribe in reasonable proportion, the Committee would have another £400 to deal with.

The vote of thanks was carried.

Mr. D. T. LIVESEY: I would like to suggest, Mr. President, that your successor should take the hint provided to-day—*i.e.*, that next year he should take the opportunity of presenting the case for the Benevolent Fund to the full meeting of members before its dismissal, instead of holding the Benevolent Fund meeting afterwards.

THE OFFICIAL VISITS and SOCIAL EVENTS

A Tour of Liverpool.

The whole programme had again been designed so as to be particularly attractive to the many lady visitors, and early on the Tuesday they set off in motor coaches on their own private tour of Liverpool. The itinerary took them past all the important landmarks of the city, and definite halts were made at Calderstones Park, at the All-Gas House of which a description appeared in our first Institution Number, and at Sir Giles Scott's growing masterpiece, the Cathedral. A return was made in time for the Institution group photograph on the steps of St. George's Hall.

M.V. "Georgic."

In the afternoon a very large party left for the Gladstone Dock, where they were entertained to tea in the "Georgic," the vessel in which those attending the Official Visit to Canada and the States in the Autumn will return home. After tea a tour of the liner was made, when many had their first sight of the sumptuous decoration and furniture of the modern "floating hotel."

The Gas Company Entertains.

In the evening the Chairman and Directors of the Liverpool Gas Company gave a reception and dance at the Philharmonic Hall. Some 700 guests were welcomed by Dr. G. C. Clayton, C.B.E., J.P., M.P., and Mrs. Clayton, with whom were the President and Mrs. Gibson. The Institution had presented to Mrs. Clayton a beautiful bouquet of orchids and lilies of the valley, and Mrs. Gibson carried a spray of malmaison carnations, the gift of the Manchester Association, of which Mr. George Dixon, now Engineer and Manager at Nottingham, is President. Mrs. George Dixon made the presentation. The Lord Mayor and Lady Mayoress, Mr. and Mrs. Alfred Gates, were among the guests.

During the evening cabaret performances were given by "The Famous Super-Optimists" and by "The Lancashire Mummers" (by permission of the British Broadcasting Corporation); and dancing to Will Ridley and "The Imperial Revellers" continued into the early hours.

Port Sunlight.

On Wednesday morning the ladies crossed over the water for a visit to Port Sunlight, where their large party was but a tiny fraction of the thousands of visitors who are entertained weekly by invitation of the Governor and Directors of Lever Brothers, Ltd. Mechanized soap-making, as viewed from the special visitors' galleries which surround the shops, provided an excellent morning's entertainment, and each lady left with a daintily packed sample of considerable utility.

The President's Luncheon to the Council.

On Wednesday, May 31, Mr. RALPH E. GIBSON, the President, entertained the Council of the Institution of Gas Engineers and many distinguished guests at luncheon in the Adelphi Hotel, Liverpool.

After the Loyal Toast had been honoured,

Mr. GIBSON, who was in the chair, proposed the toast of "Our Guests." He said it was an important feature in connection with the meeting that the President should entertain at luncheon the Council of the Institution and distinguished people both inside and outside the Gas Industry. Usually the Meeting was held in London, but he was glad that this year it was in Liverpool, for it gave them the opportunity of inviting notable local people. They were favoured that day with the presence of a number of gentlemen connected with the civic life of the City. First of all there was the Lord Mayor (Councillor Alfred Gates). It was a particular pleasure also to have with them the Chairman, the Deputy-Chairman, and the Directors of the Liverpool Gas Company, and he was glad, too, to be supported by Mr. Sandon Stubbs (the Secretary), Mr. Astbury (the Assistant Engineer), and Mr. Peake (the Company's legal adviser). It was a source of pleasure, too, to see leading officials of the Liverpool Corporation, with whom the Company were on relations of a very pleasant character. Then they had with them Mr. Arthur V. Dean (Chairman of the Liverpool Chamber of Commerce); Councillor R. J. Hall (Member of the Mersey Tunnel Joint Committee, and Chairman of the Port, Sanitary, and Hospitals Committee). They were indebted to Mr. Hall and to Mr. E. H. M. Hewitt (Engineer-in-Charge of the Mersey Tunnel) for their courtesy in making arrangements for them to visit the tunnel. The Institution of Electrical Engineers was represented by its President (Prof. E. W. Marchant), and it was a privilege to entertain also Prof. G. E. Scholes (President of the Liverpool Engineering Society). Among the guests were Prof. W. A. Bone (Imperial College of Science and Technology), to whom they were indebted for a lecture of absorbing interest; Mr. J. F. Ronca (Director of Gas Administration, Board of Trade); Mr. W. J. A. Butterfield (one of the Gas Referees); Mr. C. le Maistre (Director and Secretary of the British Standards Institution); and Mr. Will Thorne, M.P., who represented an important section of the Gas Industry and took a deep interest in legislation affecting it. There were also present Alderman Thomas Mitchell (Lord Mayor of Stoke-on-Trent), Alderman F. J. West (Manchester), and the readers of the various papers. To all he offered a cordial welcome.

The LORD MAYOR OF LIVERPOOL said he regarded it as a great privilege to respond to the toast. Since he had met the members of the Institution on the previous day he had arrived at the conclusion that gas engineers were a very fine body of men. They possessed keen business ability and were also capable of enjoying themselves; and he certainly appreciated their hospitality and kindly spirit. When, in future, he was asked by parents how they should place their boys in life, he would say, "Make them gas engineers!" He expressed thanks on behalf of the guests.

At this stage Mr. GIBSON explained that Mr. H. Tindale (General Manager of the Australian Gas Light Company, Sydney) had a message from the Australian Gas Institute.

GREETINGS FROM AUSTRALIA.

Mr. TINDALE said he was glad to avail himself of the opportunity of conveying to the Institution the good wishes and good-will of the Australian Gas Institute, and all success to the meeting. He was an Australian, and this was his first visit to England, and he could hardly express the thrill of shaking hands with many men in the Gas Industry whose names were household words in the Commonwealth. His pleasure was all the more complete because, in addition to hearing the lecture by Prof. Bone, he had also shaken hands with the lecturer himself. Prof. Bone's utterances on the Gas Industry were always carefully studied in Australia. Finally, he thought he could say with truth that in New South Wales they were following in the steps of the old Motherland.

Prof. MARCHANT gave the toast of "The Institution of Gas Engineers." He said that when requested to fulfil this duty he had felt a certain hesitation, but he had decided that electricity could be regarded as a sister industry to gas. He had come back recently from London, and had seen in the Underground and in many other places accounts of the activities of a "Mr. Therm," who worked seven days a week and never took a holiday, and so on. He thought it might be a good plan to introduce a lady, "Miss Kilowatt-hour," who, he suggested, could actually do more than "Mr. Therm." While admitting that "Miss Kilowatt-hour" might not be quite so efficient as gas as a heating agent, she could sew and do other odd jobs which "Mr. Therm" could not. Also, if he made a picture he would put "Miss Kilowatt-hour" in a more gracious costume than that of "Mr. Therm." Some day, perhaps, there would be a romance, and the two might form a partnership; but the lady might prove to be the more masterful of the two.

GAS AND MORTALITY.

It was, continued Prof. Marchant, a great pleasure to be with them that day, for the Institution of Electrical Engineers and the Institution of Gas Engineers had at least two things in common: First, they had to face the troubles met with in the streets, caused by heavy traffic. To-day the roads were carrying heavy lorries which might well be put back on the railways, and he thought the two industries might join forces in urging this. [Hear, hear.] The second point was that both industries effected a reduction of the smoke nuisance, though in this respect gas engineers

might claim that they had done more than the electricians. He had received from the Medical Officer of Health for Liverpool a statement showing the effect of smoke on mortality in the town of Salford. If they measured the acidity in the atmosphere of Salford in terms of sulphuric acid per square mile, the figure was 24 tons per annum. The mortality due to bronchial diseases amounted to over 1200 people per million inhabitants in the five towns comprising the Manchester Group. If they turned to Wallasey or Bournemouth, they found that the acidity in the air was negligible, and the mortality from bronchial diseases was only 500 per million. Dr. Frazer (the Liverpool M.O.H.) had stated that if by reduction of smoke the bronchitis mortality of Oldham could be reduced to that of Wallasey it would save more lives than would be saved by the stamping-out of tuberculosis. In this matter the electrical and the gas engineers could work together. The President of the Institution of Gas Engineers, Mr. Gibson, was an old friend of his, and a few years after he (the speaker) came to Liverpool, Mr. Gibson was President of the Liverpool Engineering Society. The Institution of Electrical Engineers were indebted to the Institution of Gas Engineers for presenting them with a beautiful plate, designed by the lately deceased Mr. F. D. Marshall (a Past-President of the Institution of Gas Engineers), for a certificate to commemorate the year of office of President of the Institution of Electrical Engineers. Mr. Marshall had also designed a similar certificate for the Institution of Gas Engineers.

Mr. F. P. Tarratt (the newly-elected President) mentioned that originally the luncheon was only a small affair, the President entertaining the Members of Council only. But the idea had developed, and they now invited other guests. Prof. Marchant, in his happy speech proposing the toast, had spoken of the possibilities of a union between "Mr. Therm" and "Miss Kilowatt-hour," and the idea of this was certainly intriguing. By the general public "Mr. Therm" was little understood, and it was nice to feel that the Gas Industry's advertising had been noticed by their sister industry, electricity. He expressed complete sympathy with what Prof. Marchant had said in regard to smoke abatement, and he was glad, too, that the plate designed by Mr. Marshall was so appreciated by the Institution of Electrical Engineers. The Institution of Gas Engineers had on several occasions been the guests of the Institution of Electrical Engineers, who had placed at their disposal facilities for their meetings.

Garston.

It was a very large party that visited the Garston Works on Wednesday afternoon, but the organization was fully equal to the task. The tour was made in small groups, each member of which wore a distinguishing button. After inspecting every section of the station, which was described in our first Institution Number on May 24, the visitors were entertained at tea in the Institute. The hearty thanks of all were voiced by Mr. H. E. Copp, and acknowledged by Dr. G. C. Clayton.

Jacob's Biscuit Works.

On the Wednesday afternoon a large party (about 350 members and their friends had accepted the invitation) left the Adelphi Hotel in motor omnibuses for the Aintree factory where Messrs. Jacob & Co. produce their very well-known biscuits. On arrival the party was divided into squads of convenient size, each under the leadership of an employee of the Firm. These young ladies were conspicuous by the whiteness of their overalls, and this, together with their capacity for answering questions, made it easy for the parties to keep together and to see in the greatest possible comfort the interesting processes by which the firm's tasty wares are produced.

The methods by which handling is reduced to a minimum, the mystery of how the filling is deposited so neatly in a sandwich biscuit, of how the snap is imparted to a ginger snap and the crackle to a cream cracker, were all investigated with great interest, but we must leave a full description of all this to the illustrated brochure which was issued to each visitor. Naturally one of the questions most asked was how Liverpool's largest industrial consumer disposes of an annual quantity of gas which would make many a small gas undertaking happy for several years. The answer was supplied by Mr. Ernest Griffiths, M.I.Mech.E., Consulting Engineer to Messrs. Jacobs, who gave details of the principle applications of gas in the factory.

The Gas Equipment.

Gas supplied by the Liverpool Gas Company, he explained, is delivered to the firm's meters—one 3000 light, six 600 light, and six 400 light—through two 12-in. mains, and distributed for use in the following processes:

(A) The baking of biscuits in travelling ovens where an unfluctuating temperature and an even distribution of heat is essential. Most of these ovens are now fitted with the "Keith Blackman" gas and air premixing equipment, which differs from the usual high-pressure gas equipment for travelling biscuit ovens in that a pre-determined mixture of gas and air is prepared at one point and distributed to the burners. The equipment consists of a double-fan motor, driven to supply air and gas at 28 and 10 in. water gauge respectively to the mixing apparatus situated at the centre of the control side of the oven, and so designed that it will maintain a constant proportion of gas to air no matter how many burners may be turned off or on, or how the initial gas or air pressures vary. As the distribution headers in this system contain an explosive mixture, it is important that any possibility of a burner lighting back should be prevented, and for this purpose special attention has been paid to the design of the burners themselves and an efficient flame check fitted on each branch between the burner and its header, rendering the risk of explosion practically non-existent.

The advantages claimed for the pre-mixture system over the individual injector system are: (1) Economy—as a better mixture can be consumed; (2) ease of control and correct adjustment of all burners; (3) less choking of the burners and injectors owing to the air being drawn from a clean source; (4) no difficulty with oil at the injector nipples as may be caused through over-lubrication of the gas compressor.

(B) The combined ovens and machines for the production of ice cream wafers, cones, cornets, and sugar wafers. These ovens are of different construction to those mentioned above, and are heated by high-pressure gas on the individual injector system.

(C) Drawplate ovens of the steam tube type, in which the ends of the steam tubes are bunched together in a combustion chamber and heated by gas at 3 in. water gauge induced by air at 30 in. water gauge.

(D) Bonecourt boilers thermostatically controlled and requiring little or no attention for heating stores where a uniform temperature is required night and day and over the week-end.

(E) Biscuit tin driers heated by high-pressure gas on the individual injector system.

(F) Canteen kitchen equipment, heated by gas at town pressure.

(G) Gas lamps of the "Rochester" and "Littleton" patterns distributed over the factory and grounds as a precaution against failure in the electric supply.

The total gas consumption per annum is 75 million c.ft.

Tea in the Canteen.

A glance at the fine gas equipment in the canteen (it was examined the greater detail afterwards) made tea seem doubly refreshing, and

Mr. W. H. Johns (Swansea) was certainly voicing the general sentiment when he proposed a vote of thanks to Messrs. Jacob & Co., who were represented by Capt. Cedric Jacob, a Director, for their hospitality in making such admirable arrangements for a most interesting visit. He commented on the cleanliness and beauty of all they had seen, and heartily thanked the guides for their share in making the visit enjoyable..

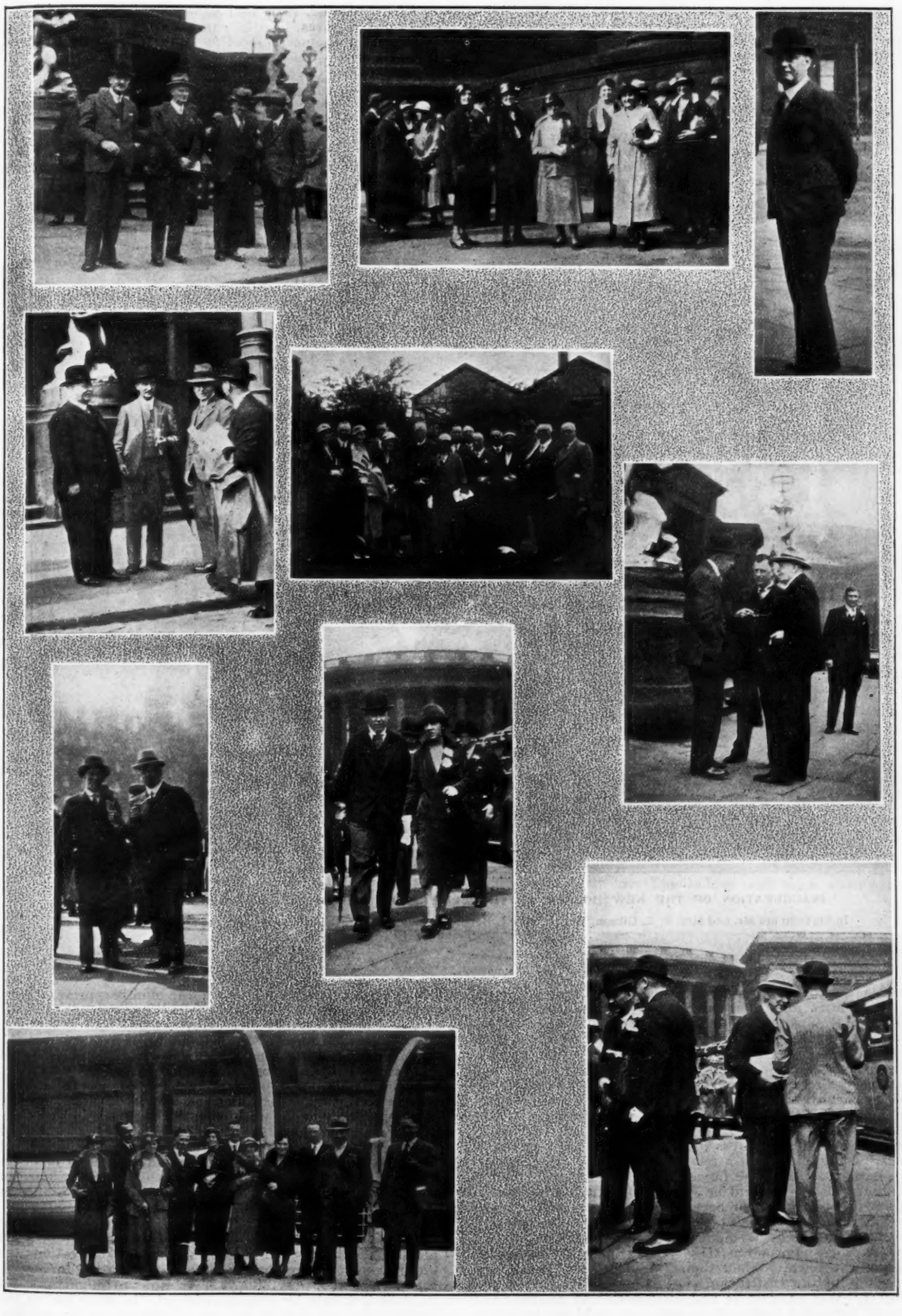
Mr. Thomas Glover, C.B.E., in seconding, cordially invited Messrs. Jacobs to Norwich. He could assure them there was room there for a factory; as a gas man he knew their consumption would be welcome, and as a Councillor he was equally certain they would be well received as ratepayers!

Captain Cedric Jacob, who incidentally is also a Director of the Liverpool Gas Company, in acknowledging the vote, explained that the size of the party had necessitated somewhat curtailing the inspection, but he assured them that there was always a welcome for any who would like to see the processes of manufacture in greater detail—some of which they had had to omit.

[An article on Liverpool's largest industrial gas consumer was a feature of the May Bulletin of the B.C.G.A.]

Civic Hospitality.

The "Journal" is devoted to the Gas Industry, and pressure on its space is vast, otherwise much space might be allocated to a description of the beauties of the Town Hall, its panelling, its portraits and furnishings. We were



privileged to take it by storm last Wednesday evening, when the Lord Mayor and Lady Mayoress held a Civic Reception. A band played in the foyer during the arrival of their guests and at intervals throughout the evening; and in the ballroom there was dancing to Collin's Band. Among the Lord Mayor's personal guests were those famous singers, Layton and Johnstone, who delighted the company with a brief entertainment.

Golf on May 29.

The early arrival of some of the visitors in Liverpool enabled them to take part, on the Monday afternoon, in a golf competition for which the President, Mr. Ralph E. Gibson, had presented a beautiful silver bowl. The competition took place under medal rules over the West Lancashire Golf Club's Links at Blundellsands, and forty-five cards were returned. Mr. C. S. Shapley, during his presidency of the Institution, inaugurated such a competition in Leeds in June, 1930, and he must then have had an interest in "futures," for he carried of Mr. Gibson's trophy with the handsome score of 89 −19 = 70. The following followed up:

J. Alex. Gray, Ashton-in-Makerfield	96−23=73
J. Sandon Stubbs, Liverpool	84−10=74
H. A. Aitken, Leven	86−11=75
H. H. Thomas, Liverpool	83− 7=76
Stephen Hay, Snaresbrook	88−12=76
Robert Wardell, Peterborough	95−19=76

The bowl was presented at the reception and dance on the Tuesday night.

The New Holder at Crowlands

INAUGURATION OF THE NEW HOLDER AT THE CROWLANDS (SOUTHPORT) GAS-WORKS ON JUNE 1.

In the front are Mr. and Mrs. R. E. Gibson, Mr. and Mrs. J. Bond, Councillors W. H. Bellis, Hindle, Dobbin, Lea (Vice-Chairman), Alderman Trounson, J.P.

Delegates to the Annual Meeting of the Institution of Gas Engineers and their friends, to the number of 560, visited Southport on Thursday, June 1, and were entertained at lunch at the Prince of Wales Hotel by the Mayor (Councillor George E. Hardman) and Corporation. Later a visit was paid to Crowlands Gas-Works, where the formal opening of a new gasholder took place. The luncheon was presided over by the Mayor, and with him were the Mayoress, Mr. and Mrs. Ralph E. Gibson, and members of the Gas Committee and other Corporation Officials. Mrs. Gibson presented the Mayoress with a basket of fruit; and each guest was supplied with a red carnation from the Corporation gardens. After the Loyal Toast the Mayor submitted "Our Guests." He said he was doubly gratified when he received word from their Secretary that such a large number had accepted the invitation to come to Southport, and they welcomed them. Southport was proud of its Gas Undertaking, as proud as they were of the other undertakings in the town. When their Engineer, Mr. Bond, was President of the Institution, unfortunately the economy "stunt" was on, and he had his function in London; but if there happened to be a President who could not house his function in his home town, well there was Southport to come to.

Mr. GIBSON, responding, said the number present indicated the great attractiveness of Southport to all of them, and he extended warm thanks for the generous hospitality and excellent provision. A gas man at once associated the name of Bond with Southport. [Applause.] The Mayor had referred to Mr. Bond's presidential year in 1914-15. It was unfortunate that he was not able to hold the conference at Southport as had been intended, but Mr. Bond was engaged on important work with the High Explosives Committee. He was asked to continue as President for a second year—an invitation which he did not feel able to accept at the time. They were glad to see him looking so well at present. [Applause.] They congratulated the Chairman and Members of the Gas Committee on having so able an Engineer in charge of the Gas Undertaking. [Applause.]

The Mayor invited Mr. Bond to speak.

Mr. BOND thanked the Mayor for making the occasion possible, and also the members of the Corporation, the Chairman and members of the Gas Committee for asking them there that day, for it gave him an opportunity of meeting not only his esteemed friend, the President of the Institution, but also of his learned friends in the gas profession. For his part he welcomed them right heartily to Southport. Among them were several learned engineers

who had served the Gas Committee in Southport, notably Mr. Blundell, who was now Engineer and Manager of the Carlisle Gas-Works; Mr. Whitehead, Engineer and Manager at Southampton; and Mr. Cook, Engineer and Manager of their near neighbour's gas-works, Blackpool. He thought the Southport Gas Committee and Council would be very proud of these men. Last year Mr. Blundell presented a very interesting paper on vertical retorts, for which he received the highest award of the Institution, the Gold Medal. [Applause.]

The New Holder at Crowlands.

On arrival at the Gas-Works, the holder ceremony was at once proceeded with; the Deputy-Mayor (Councillor W. H. Bellis) presiding.

The Chairman apologized for the absence of the Mayor, who was occupied with another engagement, and said they had all had an opportunity of meeting him and he had been very pleased indeed to have so many influential guests at his table in Southport. Referring to his own position, the Chairman said he felt rather like the publican who presided at a temperance meeting, because he held the office of Chairman of the Electricity Committee in the Corporation. [Laughter.] He happened also to be Deputy-Mayor, and, as such, he was able, he hoped, to form an unbiased opinion about the various undertakings of the Corporation. He thought he was by nature and experience "electricity minded," but at the same time he had a "gas consciousness." In Southport they had under the one control of the Corporation both gas and electricity undertakings. Whatever might be the individual views on the future of gas and electricity, the Council as a whole were agreed that everything should be done to maintain and foster the prosperity of both undertakings. The future of gas and electricity would be one of difficulty and of many problems. They were gathered together to open the new gasholder which was necessary to deal with the increased consumption in Southport. As a result of increased demand it had been necessary to erect a holder with a capacity of three million c.ft. The holder was of the spiral type, and was manufactured by Messrs. Clayton, Son, & Co., Ltd., of Leeds; and when they considered that it weighed 25,400 tons, they would realize what a difficult problem the erection had presented. The Corporation aimed at arranging matters so that they could provide the necessary illumination and heat without spoiling the beauties of the town. He thought the new holder would show that they had done this very successfully. One of the problems in the production of gas was the prevention of excessive smoke which with the other industries and factories of a town caused so much harm to many beautiful buildings; but in Southport, under the very wise guidance of Mr. Bond, the Engineer, they had been able to avoid many of these difficulties. That day marked the supply through that holder of 23,000 new consumers of the gas undertaking. That being so, it was very fitting that the opening ceremony should be performed by Mr. Gibson, who would set that holder on its way to bring light into so many homes in Southport.

Mr. Gibson expressed appreciation of what had been said about him and said that about two years ago he was privileged to visit Southport and see the foundations of the holder being put in. The holder and tank were not in

existence then, but there were great preparations with regard to the foundations which were of very great interest because they were the West-Rotinoff system of piling, which was something new to him. He was very interested

Mr. Ralph E. Gibson officially opening Southport's new gasholder by turning on the main valve to the town supply on Thursday last.

to see the method of construction, and the holder was a monument to the engineering skill and ability of Mr. Bond, whom he would like to congratulate, as well as the contractors, on the completion of the structure. Adequate storage of gas was very necessary, and the people of Southport would undoubtedly benefit from the fact that that increased storage had been provided. The "storability" of gas was a great point in favour of it compared with electricity. One of the reasons for the occasional failure of electricity was that the current was distributed as fast as it was produced. They congratulated the Gas Committee and the Corporation of Southport on their very fine engineering structure. It would be exceedingly useful for many years, because gasholders, like elephants, lived for a long time. The holder would outlive most of those present, for its age might be anything from 60 to 100 years. He was about to open a valve that would allow the gas to flow into the distributing mains of Southport, and he hoped that many thousands of millions of cubic feet would flow through that valve in the days to come.

After the ceremony Mrs. Bond presented Mrs. Gibson with a basket of fruit, and then

Councillor W. LEA, in the absence of the Chairman of the Gas Committee (Councillor Dr. Coates) moved a resolution of thanks to Mr. Gibson. He was told by Mr. Bond that the holder only contained sufficient gas for one day's supply to the Southport consumers. He was pleased with the progress that had been made at the gas-works under the supervision of Mr. Bond, who was universally held in high appreciation.

Councillor SCOTT said it was a wonderful thing that a structure of that weight had been successfully erected on some of the most treacherous land in Southport. It was founded in about 4 ft. of sand and about 9 ft. of soft peat. He claimed that the Southport Gas Estate maintained as high a standard of efficiency as any in the country, although not so large as some. He paid a tribute to the assistance he had received as a member of the Gas Committee and a past Chairman from the Institution of Gas Engineers, the B.C.G.A., and other associations, and said they had been most helpful not only to him but to many others similarly placed.

Mr. F. P. TARRATT (Vice-President of the Institution) proposed a vote of thanks to the Chairman, which was seconded by Mr. J. H. CANNING and was carried with hearty applause.

Mr. BOND expressed thanks to the contractors, to Messrs. Clayton, Son, & Co., Ltd., West's Rotinoff Piling and Construction Company, Ltd., and the F.C. Construction Company, Ltd., also to his Assistant, Mr. Jack, and his staff, by whose joint efforts the work had been successfully carried out.

After the ceremony the company toured the Gas-Works, of which an illustrated account was given in our first Institution Number, and were entertained at tea.

In North Wales

The North Wales Tour which had been arranged for the Friday proved a complete success in everything which could be controlled by the organizers. The interesting description of the route, which has been prepared by Mrs. Ralph E. Gibson and Mr. Alan Gibson for presentation to the members, acquainted those who were able to take part in the tour with the main places of interest to be visited during the drive of nearly 160 miles. Most of the day was spent in admiring the beauties of Nature, but at the very outset there was an opportunity of inspecting one of those remarkable engineering feats that seem to bring mankind some way towards the heights of grandeur achieved by Nature.

Immediately on starting from the Adelphi Hotel, the coaches and cars were privileged to pass through the yet uncompleted Mersey Tunnel, which, at a cost of 7½ million pounds, connects Liverpool with Birkenhead. When opened up next year as a public highway, the tunnel will afford ready access not only to Wales, but to the whole of the South. As the descriptive writers truly said, "it is impossible to pass through the tunnel without being impressed by the magnitude of the task which has been accomplished." The roadway which the party traversed—though wide enough for four lines of traffic abreast—occupies only the upper half of the complete section, which has a total internal diameter of 44 ft. There is an equally spacious lower half, having room for a double-track railway, together with two large fresh air ducts. When the tunnel is completed, there will be arrangements not only for supplying fresh air, but for drawing out the foul air—in addition to pumping machinery for ejecting the rain water which will collect at the centre. There will be fire-fighting apparatus, colour light signals, and complete communication by telephone—all under the supervision of some thirty police, who will patrol the footwalks.

Passing St. Asaph, the smallest city in England and Wales, with a population of only two thousand, Abergele was reached, and so through Old Colwyn to Colwyn Bay, where it had been originally intended to have lunch. Then by way of Llandudno Junction Conway was approached, and passing over the world renowned Suspension Bridge constructed by Telford in 1824, and alongside which is the tubular railway bridge, both close to the magnificent Castle built by Edward I. just six centuries ago, the gloriously situated Oakwood Park Hotel was reached, and here an excellent lunch awaited the travellers. The number who sat down was 185, including, as was pointed out by the President, some visitors from Colwyn Bay. These visitors (among whom was Miss Ethel M. Hovey, a Past-Chairman of the Colwyn Bay Urban District Council and the first lady Chairman in North Wales) were accorded a hearty welcome.

Mr. Gibson remarked that Miss Hovey and her sister had been Principals for 30 years of the Penrhôs College for Girls, and her name would be familiar to all present, who had known her brother, Mr. A. Clement Hovey, for many years. Among the other visitors was the Gas Engineer at Colwyn Bay, Mr. H. Blythe.

In response Miss Hovey said she felt it a great honour to be asked to deputize on that occasion for the Chairman of her Council, Mrs. Hyde. She expressed her unbounded pleasure at learning that her old friend Mr. Tarratt was the new President of the Institution. As a point of interest, she mentioned that she had had a house for 20 years which had been run entirely on gas.

After lunch, through the Sychnant Pass to Penmaenmawr, and thence to Bethesda, which is chiefly concerned with the Penrhyn Slate Quarries. Passing through Capel Curig, the Swallow Falls were ultimately reached, and here there was another pause to enable the famous beauty spot to be viewed. From this point the journey was resumed to Mold, where a few members of the party, to their great regret, were compelled to branch off to Chester Railway Station, while the remainder proceeded to bring an enjoyable day to a close as the guests at tea of Dr. (since Sir) G. C. Clayton at his residence, Crabwall Hall, Great Mollington.

Throughout the day the time-table was kept with a closeness which was a tribute to the organizing ability of Mr. Alexander and all those who took part with him in the arrangements.

DISCUSSIONS ON THE PAPERS

Our first Institution Number contained all the papers presented at the meeting with the exception of that of Dr. W. Beck, which was not available for publication. As the paper is subject to revision, it is not published to-day, but an idea of its nature will be gained from our Review of the Meeting.

The Coke Oven Plant at Beckton Gas Works

By R. W. HUNTER, M.Inst.Gas E.,

Station Engineer, Beckton Gas Works, The Gas Light and Coke Company.

The PRESIDENT: Mr. Hunter has placed us under a debt of gratitude for this excellent paper. A vast amount of trouble has been taken in its preparation, and I am sure it will be a very valuable addition to our Proceedings.

Mr. THOMAS HARDIE (London): I would like to give expression to my thanks to Mr. Hunter for this interesting paper, and to compliment him upon it. He has brought together a number of matters, not only of great interest, but in connection with some of which there is at present little information available. The detail which he has given of the heating-up of the ovens may be taken, I think, as an indication of the care and of the thoroughness which Mr. Hunter and his staff have taken throughout the whole construction and operation of the ovens to ensure that the best results are obtainable and that the possibilities of the plant should be known and developed. The ovens were installed so that the Gas Light and Coke Company might have complete reliable information as to the possibility of making gas cheaper in large carbonizing units such as are used for the making of furnace coke, as against the plants that we have more generally used. Every care was taken in the equipment of the plant, as far as our experience indicated, that might be advantageous to give us really good gas making results. During the construction of the ovens one could not help being struck with the accuracy with which the bricks and blocks had been made, and the same accuracy was used in building them into the ovens. The standard of work throughout was really of a very high order.

THE QUESTION OF WEAR AND TEAR.

The ease with which the excellent results have been obtained at comparatively low combustion chamber temperatures would point to a very low wear and tear figure and, I think, a long life for the oven. Indeed, I see no reason why the figure given in Table VII. of the paper should be exceeded. I notice that Mr. Hunter in that table of comparative costs of different methods of making gas has taken the same figure for intermittent retorts, in relation to wear and tear, as for continuous retorts, but I do not think our experience has been sufficiently long for us to say that that will be so, and that it may not be too high. The maintenance figure for continuous retorts is becoming less, owing to the fact that the spalling, which was common when Durham coal was being used, is being steadily overcome. Table VII., however, in which the comparative figures are given of the different types of plant, I think, represents very closely, under the conditions named there—*i.e.*, the same price of coal and coke—the relative positions of the plants as we have found them. But, of course, actual comparative data are very difficult to obtain. In fact, I do not think two exactly comparable results have been obtained. If you take capital expenditure, for instance, you can have a very different capital expenditure for the same plant in different positions. It may be due to the size, it may be due to the arrangements that have to be made for handling the coal or the coke; and the same applies to the results. Many features affect the results. The coke handling plant, again, may make the relative amounts of coke and breeze quite different from what are given in the paper. The author's figures are all based on the use of unscreened Durham coal, but our experience so far with the coke ovens is that we do not think we shall get any reduction in cost in making gas as compared with modern gas making plants. If the price of oven coke should improve, then the coke ovens may prove a salvation to those companies who have weighted themselves with a high calorific value gas, provided they are of a size suitable to such an installation.

The application of producer gas to the heating of the ovens has been most successful, and nothing has been more satisfactory than the even temperature through the ovens. The type of plant installed at Beckton gives efficient use for breeze and small coke and results in a very cheap producer gas. The plant itself is somewhat expensive, but I think coke oven managers have done the right thing—especially when we consider the price now available for coke oven gas—in saving expenditure on the producer and heating their ovens with coal gas.

Mr. FRANK P. TARRATT (Newcastle-upon-Tyne): I welcome an opportunity of making a few comments on this paper, because, although I have no actual experience of coke ovens, we have been greatly interested in them for some time past, and I have felt all along that the time has come when there should be a large-scale experiment with coke oven plant for the purpose of gas manufacture. Of course, Beckton is an eminently suitable place for such trials to be carried out. It is well out of London, and where there is a large area available for putting down a big unit. I am quite certain in my own mind that, after the experience of the Gas Light and Coke Company in working these ovens during the past twelve months, it will not be very long before they consider extending their existing battery, which, of course, must result in further economies. It is some little consolation to us who are not in a position to put down a battery of coke ovens to know that the cost of manufacture both in continuous verticals and intermittent verticals compares very favourably indeed with the coke ovens, and that we are not going to derive such an enormous benefit from the use of coke ovens as regards the cost per therm into the holder. The details which have been given us by Mr. Hunter in his paper show the great care which has to be exercised in erecting a battery of this size, but there is no doubt that the care exercised in bringing the plant later on into use will have a very beneficial effect on the ultimate life of the plant.

Reference has been made to wear and tear, but from the numbers of plants that I have seen in this country and on the Continent—many of which have been in use for quite a long time—I do not think you need have any misgivings in that respect. As a matter of fact, the condition of coke ovens which have been in constant use for 15 or 20 years is really surprising, especially when one considers the class of coal that is now being put into them.

GOOD CARBONIZING FIGURES.

A number of factors have to be thought out in connection with these plants and in regard to the analyses of the gas which are given in the paper I have been wondering in my own mind what the conditions are when heavy winds prevail. We are all somewhat old-fashioned, and for many years have had our plants housed in substantial structures, although there is a tendency now—which is undoubtedly in the right direction—only to put coverings over the carbonizing plant. Nevertheless, I am just wondering what the conditions are like at Beckton when there is a really good south-easter blowing. I suppose they have to get through and do the same as we do in our retort houses, but I should imagine it must temporarily have an adverse effect on their heats. The figures which Mr. Hunter puts forward with regard to carbonization are exceedingly good, and it is gratifying to feel that in carrying out this contract it has been possible for the Gas Light and Coke Company to secure without a great deal of difficulty the guarantee put

forward by the contractors. It is always pleasing to an engineer to feel that he can justify to his Committee or his Board the putting in of new plant, without having to place an undue strain upon that plant.

A point of some interest is the problem of dealing with the large volume of naphthalene which appears to be made in coke oven plants. They have had to adopt special methods to overcome that, and I am just wondering how this large quantity of naphthalene is brought about. I do not know whether it is due to the class of coal or the carbonizing conditions in the coke oven, but I see eventually the difficulty was overcome to a large extent by using oil in the coolers instead of water.

As you will see from the paper, the whole of the gas has to be collected together and ultimately dealt with for the removal of benzole, and I am wondering if Mr. Hunter can tell us whether there is any marked improvement in the quantity of benzole recovered per ton of coal carbonized. A good many coke oven managers have put forward startling figures with regard to what they can do in the way of recovery of benzole, and I am wondering, considering this is such a big unit and forms such a large proportion of the carbonizing plant at Beckton, whether there has been any improvement in that respect. Of course, we other managers have to be content with a matter of 2½ to 3 gallons. I should also like to ask a question with regard to sulphur compounds—which I do not see mentioned in the paper—and to inquire whether these have come down as the result both of carbonizing in the coke ovens and the removal of benzole. The only other point I want to mention is the position in the event of a failure of the water supply. I am just wondering whether some ingenious engineer on the staff of the Gas Light and Coke Company will be able to introduce a method which will avoid the necessity of closing something like 150 valves should the water supply fail. Have the Company considered how this difficulty can be more easily overcome?

Dr. E. W. Smith: The Industry is again under a deep debt of gratitude to the Gas Light and Coke Company for having had the courage to try out such a large-scale experiment as the development of coke ovens for the production of gas. My reading of the paper is that, from the Company's point of view the experiment has been an entire success, but from the Industry's point of view it is a qualified lead. The paper is of considerable importance, dealing as it does with the first application in this country of a modern coke oven battery in gas-works practice. It is inevitable that in pioneer work of this kind problems are met which require careful consideration, and the Gas Industry is fortunate in having contributions to its literature which, like the present paper, so freely and lucidly describe the experiences of those who have been courageous enough to attempt a new departure in gas-works practice. It is, however, important to know whether the problems such as are dealt with in Mr. Hunter's paper are inherent in modern coking practice. It is also necessary to determine the limitations or otherwise to the extent to which coke ovens can be applied in gas-works in this country. It would appear that the cost of production is very little different whatever modern system is used. With coke ovens the costs are slightly higher, if anything, and it would seem that coke ovens are only justified in so far as you can afford to put in a large battery of 1000 tons per day or more. That perhaps is a matter of little interest to the large bulk of our members; but just in so far as they are becoming aggregations of gas companies with centralized production, to that extent it may become of supreme importance. Another factor which, in my view, is not brought out sufficiently in the paper is that the justification for coke ovens is largely dependent on a proper sale for coke, and a sale at an enhanced price over normal gas-works practice. I see Mr. Hunter has assessed a common price of 19s. 6d. per ton for all types of coke made by the Gas Light and Coke Company. Is this a fact, or is it an assumption? Is the coke oven coke made at Beckton giving a net return equal to the coke that is produced all over the works, or is this figure just a convenient—and a quite properly convenient—method of comparison?

Producer Gas or Solid Fuel Firing?

Passing to technical and operational points, Mr. Hunter refers to the method used for heating up the Beckton battery. In giving his reasons for the choice of producer gas, less than justice was done to the method of direct coal firing. Heating up by solid fuel is by far the most usual method in the coking industry, and in many cases is the only cheap method available. Contrary to Mr. Hunter's statement, direct coal firing can give all the control of temperatures required, and heating-up curves with direct coal firing can be shown which indicate less variation from the theoretical curve than was obtained at Beckton. Heating up by direct coal firing is more cumbrous, but even on the score of cost the opinion is given that even at Beckton the cost would not have been any greater than was incurred with producer gas firing.

The system of control of battery temperatures in use at Beckton appears elaborate. The necessity of making adjustments to individual valves following the daily temperature readings, and the making of 20 to 30 waste gas analyses per day, in order to make air and damper adjustments, is, it is submitted, not representative of modern coking practice. With the producer gas fed to the battery under pressure which—since the gas is cold—is capable of fine regulation, and with the stack pull also under control, and as there is no accumulation of producer dust in the flues, it should be, and in fact is, possible to maintain in the most modern coke oven systems uniform heating from oven to oven by the adjustment of two main producer gas valves and two waste gas valves at the end of the battery. When on constant pushing schedule such adjustments are small, and are made merely by the turn of a valve wheel.

The temperatures given in Table III. show much greater irregularities than are representative of modern coking practice. It is noted, for instance, that the maximum variations from the mean wall to wall temperature range from *plus* 90° C. to *minus* 87° C.—*i.e.*, a variation from wall to wall of 177° C. It is submitted that coke oven batteries can and do work with a maximum variation of ± 25° C. from the mean. Mr. Hunter states that the dampers across the battery are adjusted to give a temperature gradient from machine to coke side of about 70° C., on account of the taper of the ovens. The temperatures given in Table III., however, do not support this statement. The temperature should increase regularly from machine to coke side and it may be taken that modern batteries are at work which conform to this within 10° C. of the theoretical line at any individual flue. It may be that further experience at Beckton will allow of a nearer approach to the ideal of best battery operation as outlined.

In reading Mr. Hunter's remarks on the producer plant, one gathers the impression that the production of producer gas from mechanical producers is not a cheap proposition. There appears to be a good deal of maintenance, and, rather surprisingly, the labour required seems to be as high as would be required on the usual step-grate producers for the same capacity. Modern developments in step grates certainly allow of 30% of breeze being used with the producer fuel. It cannot be taken, therefore, that a case has been made out for mechanical producers on the score of cost, either of capital or of operation charges.

Thick Tar and Naphthalene Experience.

The references to thick tar and naphthalene experiences at Beckton must come as a surprise to British gas engineers. The modern forms of carbonizing plant most usually adopted in this country—such as continuous retorts and intermittent vertical chambers—have proved to be free from this bugbear. It might be gathered from Mr. Hunter's paper that thick tar and naphthalene are inevitably associated with modern coke oven operation, but this is not the case, even on modern ovens which are using higher temperatures than those used at Beckton. It is quite a usual impression that maximum yields of benzole cannot be obtained without the production of naphthalene and tar of relatively high viscosity. The production of naphthalene depends on three main factors to which the gas is submitted in the carbonizing chamber—namely, temperature, heated surface, and time contact. There appears to be a critical combination of these factors which enables a maximum yield of benzole to be obtained with a minimum production of naphthalene and free carbon in tar. These critical conditions can be obtained in modern designs of coke oven. When gas is produced under these conditions, and when in addition an adequate flushing system is installed in the collecting and foul mains, the bulk of the naphthalene produced is brought down in the primary coolers and gives no trouble there. Most of the remaining naphthalene comes down in the final coolers, and the rest is removed by the wash oil in the benzole scrubbers. It is possible to deliver debenzolized gas in this way containing not more than two grains of naphthalene per 100 c.ft., and the tar produced has a specific gravity of about 1·16 at 15° C., with a free carbon content of about 5%. With such a tar separation from liquor is simple, and there is no difficulty in obtaining tar with not more than 2½% liquor. It is interesting to note that gas oil is used as the cooling medium on the final coolers at Beckton. Has the ammonia in the gas any adverse effect on the viscosity of the oil?

While the hydrocarbons removed from the gas by the gas oil are relatively insignificant at Beckton, and are, in fact, to some extent recovered in the carburetted water gas plant, they represent approximately 0·13 gallon of benzole, which, taken at 1s. per gallon on a 1000 ton per day plant, would represent about £10 a day. In an ordinary coke

plant, where there is no water gas machine, this represents a loss which cannot be allowed, and it would be necessary to take steps to recover it by distillation of the oil.

The gas making results shown in Table II. may give the impression that there is necessarily an increase in thermal yield with the slower coking time. Durham gas making coals have been coked in a modern oven worked at a rate 25% faster than the fastest rate given in the table; the thermal yield being comparable with those obtained at the slower coking rates at Beckton. When on the 19 hour coking time, why were the temperatures not increased in order to improve the thermal yield?

Comparison of Costs.

Referring to Table VII., where a comparison is made on the basis of costs of gas manufacture in four types of carbonizing plant, there are several points which require consideration before accepting the conclusions drawn from the data. The figures show that coke ovens give the lowest cost *per ton of coal*, but owing to the lower yield of gas the cost of gas from coke ovens is greater per therm than from either continuous verticals or intermittent vertical chambers. Since the coke oven data is given for a 1200 ton per day plant, presumably the costs for the other plants are on the same scale; but supposing the plant is only 500 tons capacity, then it will be found that the cost of manufacture in continuous and intermittent verticals will remain at approximately the same figure, but the cost with coke ovens will increase very substantially. For instance, the same charging and pushing machines and coke car will be required, and therefore the capital cost *per ton* is increased. The labour required will be relatively little reduced. In fact, coke ovens can be operated as economically as other forms of carbonizing plant only on throughputs of the order of 1000 tons per day and upwards. There are certain details in Table VII. which may be questioned. For instance, it is not universal to credit the intermittent verticals with a greater production of tar than continuous verticals. Further, it is rather surprising to find that intermittent verticals make rather more breeze than continuous verticals. One would like to know whether the breeze screen is the same size, or whether there is some special factor which affects the breeze production.

One more point is that it is well known that wear and tear on carbonizing plant on gas-works depends largely on the variations of throughput and on the shutting-down necessary to meet the seasonal fluctuation. Are the figures for wear and tear given for all four plants on the same basis of variation in throughput? Wear and tear figures for coke ovens are often misleading, as normally coke ovens operate on a relatively steady load for many years. Mr. Hunter's general conclusion that coke ovens prove superior only when favourable prices can be obtained for the types of coke produced, can be accepted as true and, one might add, only for large carbonizing capacities and in instances where a relatively high calorific value is required. The importance of the coke factor in coke oven economics is more especially brought out in Mr. Evetts' paper.

I do not want to finish what I have to say on this note of apparent criticism. It is not criticism, because I am desirous of adding to the technique of the Industry by trying to deduce as much information as possible. No one appreciates more than I do the great value of this work, and the courageous candour of the paper. It will bear the closest scrutiny and be a source of reference for a long time to come as to the manner in which these things should be tackled and done. Therefore, I should like to add my testimony and congratulation to Mr. Hunter for his valuable paper.

Ash Distribution.

Mr. H. D. Madden (Cardiff): The reason I believe I am speaking here to-day is because Mr. Hunter considers me the oldest friend that he has in the Industry. I remember the day he came to the Gas Light and Coke Company. We struck a friendship then which has continued ever since. I have been reading his paper, and have been struck with the extreme care that has been bestowed on the details of construction and afterwards to the working points, together with the broad-minded care that has been given to the question of heating and working the plant, and knowing Mr. Hunter as I do I know that is fully in keeping with his character. I had the pleasure of seeing the ovens at Beckton before they were completed, and the discussion I had with Mr. Hunter then was because he was going to use through-and-through coal, and not washed coal. Coming from an area where coke ovens are plentiful, and where nothing but washed coal is used, I felt some little doubt with regard to the coke that would be produced from the ovens, knowing the hard nature and high ignition necessary for these cokes, especially for domestic purposes, and I thought it was a serious point. It did not seem to trouble Mr. Hunter much, however, and I have been wondering how he has got over that difficulty. I see that blending of the different coals had been tried. I have done work myself for some years on blending, and I know that cokes may benefit from it, but there is one point—the resultant ash in the coke and the distribution of it. I have been looking into this question recently in regard to better crushing of coals, and I should like to ask Mr. Hunter if he attributes, I will not say his immunity from ash, but the way he gets his coke to be easily ignited, to the crushers and the better distribution of the ash right throughout the coal in the charge. My Company desired to put up a battery of coke ovens, but it was quite impossible. Although we have plenty of ground, the proposal had to be turned down because our works were too close to residential property, and we were afraid of the amount of steam that would be coming off. It is only on works such as Beckton that such installations can be erected, and I think we owe a debt to the Gas Light and Coke Company and to Mr. Hardie and Mr. Hunter for giving us the benefit of this wonderful plant.

Mr. N. J. Bowater: I wish to associate myself in the remarks of previous speakers in congratulating not only Mr. Hunter on his interesting contribution and the Institution on receiving it, but I would also like to congratulate Mr. Hunter on having such a first-class plant to describe. A number of points that I was going to raise have already been raised in the discussion, and consequently I will not repeat these; but there are still a number of points about which I—and I think the Institution—would like to have information.

Mr. Hunter has already explained that a typographical error has crept in in connection with the carbon in the ash from the producer grates and that this figure should have been 10·2%. It is, however, still not quite clear what he means when he goes on to say that the producer ash contains about 75% of pan breeze. Is it to be understood that 25% of the refuse removed from the grates consists of ash containing 10·2% of carbon and that the remainder is pan breeze? If so, it would be interesting to know the carbon content of the pan breeze.

The temperature of the outlet flue gases is stated to have been well under the 260° C. guarantee, and it would be interesting to know whether this is the temperature at the base of the chimney or the temperature of the flue gases leaving the regenerators. Under "Charging," Mr. Hunter states that the leveller door is kept closed until the coal ceases to run. It would be interesting to know whether no further coal runs after the leveller door is opened and the leveller is put into operation.

It is stated that scurfing of the ovens is avoided as far as possible; but apparently some scurfing is necessary, and I would suggest that this is rather surprising in view of the low temperatures employed. This question of temperatures I shall be referring to later.

It is stated that, to assist in maintaining equal gas pressure in each main, the mains are fitted with recording thermometers and the gas flow is balanced to give a temperature of about 100°. I should be interested to know how the gas flow in each main is actually balanced, as neither the fitting or recording thermometers nor recording pressure gauges would accomplish this, and it is not clear whether each main is provided with a draught controller.

Under "Primary Coolers" it is certainly rather surprising to find when cooling the gas down to 25° that naphthalene troubles arise, and it suggests that the coolers are inadequate for the job. I believe that the coolers have a total of some 18,000 sq.ft.—a surface far below what I should consider requisite for the volume of gas in question. Indeed, on referring to the specification for the Beckton plant of the firm with which I am associated, I find that the cooling surface of the primary coolers then offered was 40,000 sq.ft. I think it will be clear that, in endeavouring to cool the gas to 25° in coolers of 18,000 sq. ft., something approaching shock cooling was occurring, which would account for the naphthalene being thrown down.

The further difficulty with the naphthalene coming down in the main between the tar extractors and the exhausters in the winter time would have been avoided by placing the tar extractors after the exhausters or final coolers and not permitting the tar extractor to act during winter conditions as a further gas cooler, while the very absence of the tar in the gas would assist naphthalene deposition.

Since the turbo-exhauster is already a most effective tar extractor, I would suggest that the rational position for a tar extractor for removing the last traces of tar that remain in the gas would be before the ammonia scrubbers, unless of course a tar extractor capable of dealing with hot gas is employed.

It is stated that the final coolers designed for the normal coke oven practice of direct cooling of the gas by the circu-

lation of cool liquor proved unsuitable, but I am rather at a loss to understand where (apart from America) this can be described as normal coke oven practice, and I should also be interested to know what are the modified heating arrangements of the ovens referred to by Mr. Hunter. Does this refer to the so-called Koppers circulation system of heating? Again, under the same heading Mr. Hunter speaks of the comparatively high carbonizing temperatures producing a higher viscosity tar and five times the naphthalene concentration as in similar plants carbonizing lean coals, and I submit that 1233° C. measured during the last twenty minutes of a reversing period can certainly not be described as a high flue temperature, and would suggest that the naphthalene troubles are not due to flue temperature *per se*.

As regards the carbonizing of lean coals, I have experience of two plants carbonizing the same lean coals at the same rate, on one of which naphthalene troubles were common and on the other unknown, and the troubles were undoubtedly due to other causes than the flue temperatures and were probably due to hot oven tops and inadequate cooling plant.

The naphthalene trouble that occurred in the final coolers and necessitated their being converted into naphthalene scrubbers is due, of course, to the primary coolers not performing their normal function of slowly cooling the gas and bringing down the naphthalene in solution in the tar, with the result that they were—to use an Americanism—" passing the buck " to the secondary coolers.

It will be very interesting to have particulars of the volume and calorific value of the producer gas made per ton of the fuel employed. The fuel consumption of the plant on the basis of dry and ash-free fuel is very good indeed, and it would be interesting to know what the gasification efficiency of the producers was. It would also be interesting if Mr. Hunter could give us volatile content of the coke produced.

I would again take the opportunity of congratulating the Institution on having such an exceedingly interesting paper presented before it and the Gas Light and Coke Company on their courage in going in for such a large-scale experiment, and I trust that the paper will be the precursor of others on the same subject.

Mr. Hunter Replies.

Mr. Hunter replying to the discussion said: Some of the points that have been raised I would prefer to reply to later on in writing, but I will try to answer other matters now. In the first place, I would like to thank Mr. Hardie for what he said, and for backing me up in the manner he did. The effect of high winds upon the heats in our plant was mentioned by Mr. Tarratt. As a matter of fact, we have had some very strong winds, but the prevailing winds at Beckton are south-westerly, and we have not noticed anything serious as regards their effects upon the heats. I really do not think there has been anything worthy of note in that respect. There might have been some slight cooling on the ends facing south-west, but nothing to call attention to. Naphthalene troubles were also mentioned by Mr. Tarratt, Dr. Smith, and Mr. Bowater, and on that point I would say that the naphthalene troubles we experienced were due to our deliberate intention of working the primary coolers originally in the design to deliver gas at 35° C. It was the intention to obtain ammoniacal liquor from them which was free of free ammonia, because we have a system of working in our ammonia extraction which has been found advantageous. Therefore, it was deliberately intended to work the outlet temperature of the primary coolers up to 35° C., and to do the rest of the cooling in the final coolers. That is what they were designed for. With regard to my reference to the concentration of naphthalene appearing in certain cases where lean coals were being carbonized, this was due to evidence that we had from inquiries on the Continent where such conditions existed, and there it appeared that naphthalene was passing into the final coolers —at the same temperature of the gas as we were aiming at—to the extent of about 20 grains, as compared with 100 grains that we were getting, and there was no doubt that the final coolers under these conditions were unable to arrest the naphthalene. The excess of naphthalene that we did experience was no doubt due to the production deliberately of a high gaseous therm yield. We know the top heats are probably abnormal, but since we have adopted the present method of working we have been going along comfortably and see no reason to change. The cooling is being done quite satisfactorily, and with the use of oil, as I have described, we have no trouble at all. We realize that we still have a great deal to learn concerning this plant, and that there is a reserve in hand by working up to higher temperatures. We can increase the throughput of the plant, but what effect that would have on the naphthalene production I do not know. At the same time, I do not anticipate that there should be any more trouble than there was when we were on full load and full temperatures—*i.e.*, about 1230° C.

I cannot give the benzole yield separately from the coke oven gas, because it is mixed with the coal gas benzole from the other sections before treatment. The yield we are getting from the whole of the coal gas is about 3·1 gallons per ton, and if anything I should say that the yield from the coke oven gas would be slightly better than from the other sections. The calorific value of the coke oven gas is slightly higher than of the gas from the other sections. The sulphur compounds have been reduced from about 26 grains to from 5 to 8 grains, which is a very considerable reduction.

Enhanced Price for Coke.

It was suggested by Dr. Smith that the justification for the introduction of coke ovens more or less depends on an enhanced price for the coke, and I did try to hint at that in the paper. We certainly realized that this has a very important bearing. The prices I have given for coke are only comparative, and do not apply to Beckton. At the same time, oven coke is finding its place in the market, though at the moment we would say it is too early to indicate what the final position will be with regard to that. Nevertheless, we do agree that it has a very important bearing on the results. The large amount of adjustment that has been indicated in the paper as necessary to maintain the regularity of the heats, &c., is, of course, due to our experimenting. We have been experimenting the whole time with variations of blending of coals, temperatures of carbonization, and types of operative, and we have also been endeavouring to become familiar with the plant in every respect under these varying conditions. With regard to heating by producer gas, we realize that coke oven people have a great deal more experience in this matter than we have, and I simply give you the facts as we have experienced them. We have not had much trouble with carbon in the free space in the retorts, or in the ascension pipes. We are really fairly free from that now, and, as I have already indicated, naphthalene is well in hand, so that we are having no trouble in carrying on.

I was asked by Mr. Madden how we managed to make the coke suitable for domestic use. We are blending Durham gas coal with various coking coals, and we have improved the general characteristics of the coke. Although in the Gas Light Company's area oven coke is not used for open fires—we have a special coke which is recommended for that—nevertheless for domestic heating, boilers, &c., oven nuts are becoming very popular, and for many industrial uses the various grades are making headway. With regard to crushing, we think that the Bradford breaker is a very valuable asset in cleaning coal, and in the crushing by the hammer mills the remaining ash is so distributed that there is no possibility of any shale and very little danger of clinker in the ordinary way of working. Our experience from what we have learned from customers is that once they get accustomed to this coke it behaves with great regularity.

As to the temperature of the waste gases, asked about by Mr. Bowater, that was taken at the chimney damper. With regard to Mr. Bowater's point as to what is meant by the leveller door being left closed until the coal ceases to run, it is simply that we want to maintain the temperature of the steam jets to draw away the stream of gas, and we do not open the leveller door and break the vacuum until the coal has ceased to flow out of the charging lorry. Then we introduce the leveller, which stirs it up sufficiently for the remainder of the charge to flow in. We realize, of course, that turbo-exhausters are good tar extractors, but owing to our method of working to get a high gaseous therm yield per ton there is no doubt that the nature of the tar is considerably altered, and there is not so much absorption of the naphthalene by the tar in the primary coolers as there might have been. At the same time, the tar was unsuitable for working in the way it was intended in the final coolers, and consequently the turbo-exhausters have very little to do in the way of extracting tar even at the temperatures we are working at now. The question of whether we have or have not worked at too high a carbonizing temperature is a little difficult to answer. Compared with the temperatures we are working at the combustion chamber of our retort house the temperatures on the ovens are low, but compared with many other instances of oven working that we have seen and learned about our temperatures on the ovens—the actual carbonizing temperature within the oven—is pretty high. In our type of oven we have a higher temperature than is normal with coke ovens. No doubt that is the point with which a good deal of this question of the limiting conditions of tar and naphthalene formation is concerned. I will give in the written reply figures as to producer efficiency. The calorific value of the producer gas is 123-125 B.Th.U. I think Mr. Bowater asked for the volatile matter in the coke; it is 1%.

Electrolytic Corrosion in Gas Mains

By Dr. W. BECK,

Kaiser Wilhelm-Institut fur Physikalische Chemie und Electrochemie, Berlin-Dahlem.

The PRESIDENT: We are very much obliged to Dr. Beck for coming all the way from Berlin to speak to us on a subject of which he has made a special study. The paper is rather out of the ordinary, and will be very useful to many of us. If we can find out how to prolong the life of our underground mains, and avoid some of the troubles which we all know about, we shall have accomplished a great deal, and I believe Dr. Beck's investigations will help us. I am sure I am expressing your wishes when I say that we do thank Dr. Beck very heartily for his contribution. [Applause.] I will call upon Mr. S. C. Bartholomew, of the General Post Office, to open the discussion.

Mr. S. C. BARTHOLOMEW: It was rather a surprise to me to find that I should have to open this discussion. I thought I might say just a few words, and butt in at some point; but this is a greater honour than I expected, though, of course, I appreciate it very much. I am really a communications engineer, and as you know—but perhaps you do not know, because you have not thought about it—we really are in a very bad state. We either get our cables damaged by our own cousins—the traction people—with electric currents, or else we are blown up by the gas people, and yet the Post Office does not do any of them any harm. [Laughter.] First of all we are friends with the gas people about electrolytic corrosion, and, on the other hand, we are friends with our cousins the high-tension people when it comes to a question of being blown up. [Renewed laughter.] With these few opening remarks, perhaps I may deal with one or two points arising out of the paper. First of all, however, may I say that anything I mention represents entirely my own views. There is nothing official about it in any way.

A SERIOUS PROBLEM.

I have been associated with work on electrolytic action for many years, and I can say right off that it is really a very serious problem, and a growing one. Since the war, as you probably are aware, the loads on tramways and electric railways have increased, and the amount of stray current circulating in the earth has gone up in proportion, and I think it will really become something which, in the future, will have to be tackled a little more seriously by most bodies having metallic structures in the soil. Dr. Beck, in the first part of his paper, deals with the measurement of current which has strayed on to the pipe and is then leaving it for the soil. The problem so far as Post Office cables are concerned is very much easier than is the case with your gas pipes. As you probably know, we have generally at intervals of 176 yards boxes through which the cables pass, and it is a simple matter to make measurements in a cable which is practically suspended in the air. You can either cut the sheathing temporarily and put a measuring instrument across the gap, or, better still, we have developed means by which you can measure the current without actually cutting the sheath at all. By other more complicated methods it is also possible to find how much current is leaving between any two boxes. By taking simultaneous readings over an equal length of cable sheathing between two street boxes, and by superimposing the record taken photographically, you can find out how much current is leaving that particular length. The problem of the Gas Industry, however, is a much more difficult one, because you have to open the ground, as Dr. Beck points out, to get at the pipes; and even when you know there is a disturbance, you cannot possibly know precisely what is happening. In that respect I am not quite clear that Dr. Beck's method will not involve interfering with the ground condition. As you have, of course, noticed his tests have been made in the laboratory; and although I have not gone very thoroughly into the paper, it seems to me that to apply that method in practice would necessarily mean interfering with the soil, unless he is going to have fixed points where he makes his test. That may be of value, or it may be of no value, not being at the place where you want it.

A FRENCH THEORY.

There was one point in connection with these tests as carried out in which Dr. Beck differs from some previous tests by Prof. Chappuis, in Paris. Prof. Chappuis is the consultant, I believe, to most of the gas people in France, and he has a theory, which he holds very strongly, that stray currents in a gas main or any other metallic structure increase as time goes on. His theory is based on the well-known laws of electrolysis, that metal will leave the anode and flow to the cathode, and his point is that the metal leaving the pipe or metallic structure deposits filaments of metal in the soil, thus decreasing the resistance between the anode and the cathode with time. Consequently, although you start with a few milliampères of current, you eventually reach (say) one ampère, owing to this metal filling the soil in between the two points and so reducing the resistance. Prof. Chappuis indicated that quite clearly in some small-scale experiments when he showed small cells taken with X-rays at various times indicating these films of metal. In the British Post Office we rather doubted whether that would operate to the extent suggested, because the experiments of Prof. Chappuis were made on a very small scale; and, of course, when you are dealing with leakage from electric tramway and railway systems you may be some hundreds of yards away, which would reduce the resistance, and you would require a great deal of metal to fill up the soil in the manner suggested by Prof. Chappuis' small-scale experiment. As a matter of fact, some experiments which were carried out in the Post Office Research Section do not support Prof. Chappuis' view.

In his experiments, Dr. Beck shows that in the case of an unprotected pipe the resistance goes up instead of going down, as was claimed by Prof. Chappuis. Dr. Beck shows that the resistance actually goes up owing to the accumulations of corrosive matter on the pipe. A good deal of Dr. Beck's paper deals, however, with protective coatings. A considerable amount of work has been done on these in America, but I do not think there has ever been such a comprehensive study as has been made by Dr. Beck. The Americans have tried various coatings, but mostly they have failed. My own view is that a protective coating from the point of view of protection against electrolytic action is of very little use, unless we are going to find the perfect coating, because you are bound to get cracks on bituminous bound coverings, owing to their brittleness, or even with other things. There are bound to be little holes, and in that case the remedy is worse than the disease, because you get an accumulation of current at these little points, and the damage is increased because it is concentrated where these holes exist. Perhaps I need not recall to you that as much as 20 lbs. of iron will be eaten away by an ampère of current flowing for a year. If you get a constant load from an electric railway or an electric tramway (say) for 18 hours a day going on day in and day out at a little opening, you can see that very soon you will get a hole, no matter how thick your pipe may be, and a point which has struck me about this paper is that it deals with the problem wholly from the defensive point. You are tackling this electrolytic trouble by covering yourself with armour—*i.e.*, you are not doing anything—you may be doing something that I do not know of—but you do not seem to be doing anything to look after the other point of view, and that is to prevent the current getting on to your pipe.

ISOLATION OR ELECTRICAL DRAINAGE.

What you are doing is to put on an armour, but, of course, there is a much wider aspect—namely, how to treat the power system generally. There are two schools of thought on this mater. There is the European and the American, roughly speaking. The Americans (probably owing to the fact that they have very few regulations, and that in most States it is a case of "Go as you please," and the leakage currents from tramways and electric railways are very considerable indeed) have had to tackle the problem by electrical drainage—*i.e.*, they have had to join their pipes and cables actually on to the negative return of the tramway or railway system, and so provide a path back conductively instead of electrolytically. In Europe, on the other hand, generally speaking the other method has been adopted—*i.e.*, isolation. They say, "Keep everything away from the electric railway; do not join anything to it at all." There is a Swiss Committee composed of gas, water, electricity supply, electric traction, and

Government telegraph and telephone representatives. That is a Joint Committee which has unanimously expressed itself in favour of isolation as the method, and it keeps a staff of engineers who will examine any system and find out whether it is being run properly. In Germany, also, I believe, they forbid this electrical drainage system. In Great Britain we are in a half-way position, because there are certain regulations of the Ministry of Transport which provide for the negative busbar being deliberately put to earth, and that, I think, is not done in any other country in the world. It is not general on our electric railways at the moment, but in the end we shall probably have to choose in this country between the isolation system and the electrical drainage system. While I am about it, I might say at this point, on the question of co-operation between the various interests, that there is an international body referred to by Dr. Beck called the Commission Mixte Internationale, which is composed of the power interests, of Government telegraph and telephone administrations, electrical manufacturers, and some gas interests, as represented by Prof. Chappuis, who is one of the Presidents of one of the Committees which deals, among other things, with this question of electrolytic damage and chemical corrosion. A few years ago, when this body was set up and introduced an associate membership, I wrote—because I was a managing reporter on this body—to my friend, Mr. Alexander, the Secretary of the Institution of Gas Engineers, about this matter. Unfortunately, I thought at the time, and still think, that you failed to rise to the bait. Personally, I think it would be a very good thing, as this problem will become a more and more important one, that you should join that body. It has a very small fee, but it has some most important Committees representing all countries studying various questions connected with electrolytic action. I conclude by saying again that I regard it as a great honour that you should have invited me to take part in this discussion, and especially to open it.

Mr. C. A. Masterman (Gas Light and Coke Company): I am also very glad to have an opportunity of congratulating Dr. Beck on a very interesting paper and for pointing out that when we come to technical matters international co-operation can be extremely useful, I hope to him as well as to us. I have had very little opportunity of going through the results which Dr. Beck gives in his paper. There is an immense amount of matter in it, and although I struggled with it over the week-end it was rather difficult to compass the whole thing. I am, however, hoping to get much more information from it during the coming week-end. In the circumstances I find myself a little disqualified from discussing the results, but there is one point which I think Dr. Beck omits on which we have done a certain amount of work and seems to me very important—*i.e.*, the rotting effect on some of the coverings which are otherwise perfectly satisfactory. According to certain laboratory tests, the electrical resistance may be high; but under conditions of bacteriological attack underground some of these coverings do go wrong very quickly. I do not see any reference to that point in the paper although I may have failed to see it.

The question of the protection of pipes underground is one which sometimes may have less importance attached to it than it deserves, because if one is negligent or careless about protection when putting down a pipe the cost of that negligence may only come home after a period of time when the people responsible may no longer be there to take the blame. If one analyzes the potential cost of such negligence one does see the importance of it, but it is only latterly, I think, that that importance is being appreciated.

Wrapped Pipes and Pitch Troughing.

As a matter of interest as regards our own practice, we have been using wrapped pipes and also pitch troughing. The latter has been found to be thoroughly reliable, and after a period of 30, 40 or 50 years one finds the pipes in perfectly good condition. On the face of it, wrapped pipes appear to have advantages, but in so far as any spot on the pipe open to attack may lead to a more serious attack than a totally unprotected pipe may be liable to, you have to be especially careful about joints. For joints, so far, the only satisfactory protection we have obtained is by putting a short length of troughing there. Analyzing the position, it seems very often worth troughing the whole pipe and making a thoroughly good job of it. I may say that both for the pitch used for troughing and the bitumen used for wrapping pipes we are working to a very close specification, the result of which has been that we are now getting results with pipes which a few years ago would have been out of the question. It is now only a matter of time before we see the practical effect of the measures we have taken. We have down a number of test pipes in the soil, some of which are subjected to an electric current flowing the whole time. All these pipes are examined electrically at intervals. We are getting a number of curves which will be very difficult to interpret, but in course of time these pipes will be taken up and I hope will give us very useful information. This question of corrosion is a very long-distance thing, requiring watching over a period of years, and although it is frightfully important it is the long period of time which makes the work so very difficult. As regards any new method that occurs to us now, we could not obtain any really reliable figures for perhaps three or four years. I am very grateful for being given this opportunity of speaking on Dr. Beck's paper, and I would thank him for the very interesting figures in it, which I propose to look into again.

Mr. Ulick R. Evans: I have read and listened to the discourse of my good friend Dr. Beck with a very great deal of interest. I am not speaking, I am afraid, as a gas engineer. I am merely an electro-chemist who is rather particularly interested in the problems of the corrosion of metals. I have been specially interested in the method of testing coatings which Dr. Beck has developed, depending, in effect, on the taking of time/current curves. He shows how in certain circumstances the current tends to increase with the time, indicating, presumably, an extension of the damage, whereas in other cases the current falls off with the time, indicating probably, in general, a sort of healing-up effect. Particularly interesting is the case he mentions where a sort of cement-like layer consisting of sand grains apparently cemented together and on the metal compound—rust or some other iron compound—causes a diminution of the current. That may seem to suggest a line which we can develop in the attack on this problem.

Experiments at Cambridge University.

At Cambridge University, in a connection which has no immediate interest for the Gas Industry, we have been studying protective processes, and we have found that a great many of these bodies which have a specific tendency to stop the corrosion process really depend upon precipitating iron compounds in physical contact with the metal, so that instead of getting soluble iron salts which perhaps form rust out of physical contact with the metal, we get precipitation on the metal so close that really the process is gradually stifled and tends to stop. Generally speaking, you can include in that class of body such a body as potassium chromate to which is sometimes added oil and water to prevent corrosion where otherwise you would get corrosion. You may include in the same class red lead, which, not for underground purposes, but for overground purposes, is used in many coats of paint. In some of the experiments iron has been shaken up in tubes containing water and oxygen. The iron is perfectly bare, and if there is nothing else present you get rust. If, on the other hand, the tube also contains red lead, in spite of the fact that there is no oil present and that the air and water still have access to the metal, you will get practically no corrosion. It is a specific effect, and according to our experiments it is due to this fact that you get precipitation in physical contact instead of out of contact. Another case is lead chromate, which also is used in paints, and which causes this prohibitive effect in test tube experiments. The chromate experiment may have a certain bearing on Dr. Beck's results, because it is found in that case that the yellow chromate pigment particles become cemented, and you get the same action which precipitates the iron salts *in situ* next to the metal in the case of potassium chromate. The yellow chromate particles are cemented to the metal rather in the same way as I understand the sand particles were cemented to the pipes in Dr. Beck's experiments. That suggests that possibly if this sort of work was extended, introducing into your black mixtures, either for painting or wrapping or dipping, bodies which are known to have this specific precipitating action, quite conceivably—I will not make any promise—even more favourable results could be obtained.

Another point I should like to raise is that we have found in these experiments that certain siliceous bodies containing silica have a specific inhibitive action on the corrosion process. That suggests possibly that in this sort of experiment the use of a sandy soil may give a rather different result from other sorts of soil and—I only throw it out as a suggestion—it may just conceivably be why Dr. Beck in his experiments on uncoated pipe sections got somewhat different results from those obtained in the French work to which Mr. Bartholomew has referred.

I should also like to refer to a point touched on by both the previous speakers—*i.e.*, the way in which these coatings, if they are not quite perfect, tend to localize and possibly intensify attack. Supposing one imagined a pipe covered over with a relatively thin film of paint, and you make a scratch on it locally. The fact that most of the surface of the pipe is covered by that paint will undoubtedly, other things being equal, reduce the amount of electric current which will leave the pipe, because it will increase the resistance of the whole circuit; but if the soil

immediately surrounding the pipe has a fairly high conductivity, and if some other part of the soil surface has a low conductivity, then the reduction in the total amount of current flowing will be very much less than the reduction of the surface exposed. Consequently, although the total corrosion may be reduced, the corrosion per unit of area of the parts still exposed will be enormously increased, and far from making things better you will make them worse. That is one of the most objectionable features of these stray currents. They make the sort of precaution which you would take to deal with ordinary corrosion not only ineffectual, but sometimes very much worse than useless. I would not say that under all conditions you will necessarily get an intensification of attack. I think where you are dealing with perhaps several coats and the stray current has to find its way past them and go through pores or failures or local weak places in several coats, one may even get, although you do not stop corrosion altogether, rather less attack locally than if you had no coating at all. I do think that in dealing with work of this nature it is necessary to study not merely the total amount of corrosion, but the way it is distributed, and perhaps, in cases where it is possible to give some sort of information about the depth of pitting—the depth of penetration—within the period of the test.

Mr. F. C. Smith (Gas Light and Coke Company): The paper by Dr. Beck is very informative, and one feels that it requires a good deal of time to look up some of the original references quoted in order to get the best out of the paper. I think we are all agreed that the need for protecting our distributing systems against the agents of corrosion is very important. On occasions I have had to try to make some kind of electrical survey of pipes and find out just where the current is coming from and something of the nature of the strength of the current, and it may be of interest to state our experience in that connection. I gathered when Mr. Bartholomew was speaking that the Post Office problem is simplified because they can sectionalize their system between boxes and measure the loss of potential along the line between the boxes. As a matter of fact it is possible in gas engineering practice to do something similar to that. It often happens that there are a number of services coming from a main that is suspect, and one can make connections between the services coming from the main and measure the drop of electrical potential between these services. Although the figures you get will not be absolute, they will give you an indication of the way the current is flowing, and knowing something of the size of the main one can get a fair index—I only put it at that—of the strength of the current flowing. In reading Dr. Beck's paper rather quickly it occurred to me that in practice it would be difficult to use the method he has proposed, but there must be some explanation that he will probably be able to give us.

Varying Current.

When carrying out surveys of pipes which have been affected by leakage currents from traction systems one has found that the current is varying so rapidly at times that it is almost impossible to get any idea of what its strength is, and also its density. Of course, the curves given by Dr. Beck in which he has plotted the increase of current against time are extremely interesting, and I should judge from the description he has given that he has examined many of the same products that we have examined. As a matter of fact, our methods of examination have been very similar. We have measured the electrical resistance of the coating when it has been immersed in tap water, and we have then plotted the resistance against time. That is practically the same thing that Dr. Beck has done, and we agree, generally speaking, with the results in the paper. There is one point, however, that I feel we ought not to lose sight of in this discussion, and that is that we not only have to protect against electrolysis, but we have to protect against soil corrosion; and it would seem possible that protective coatings which are effective against electrolysis or are used for that purpose may even serve in some measure and be successful against soil corrosion. We feel that if we can keep the liquid water in the soil away from the surface of the pipe we should have gone a long way to prevent soil corrosion. If you have a coating that is waterproof and has a high electrical resistance at the same time, it is possible that you have done two things in one—namely, kept the water from the surface of the pipe and also increased the total resistance of your system, which must, of course, decrease the amount of current you can carry. I am well aware, of course, that you have to get rid of the current you are carrying and that you cannot completely protect the system, and it therefore becomes necessary to find suitable leakage paths as has been suggested.

There are one or two points I should like to mention in connection with the third part of the paper dealing with mechanical testing. We have tested a number of the coatings that have been submitted to us for mechanical strength, and we feel that this is a very practical problem. We put our pipes in the ground and protect them effectively, and then perhaps a careless navvy comes along excavating in the district with his pick and shovel and spoils the surface of the protective coating. Therefore, we use a mechanical test which is somewhat similar to giving the pipe a blow with a heavy, sharp chisel to see if that kind of blow will destroy the coating. We have found, as Mr. Masterman has said, that pitch troughing is very effective, and a great deal has been done to improve the technique of that process. Perhaps one or two facts with regard to that may be helpful. One has often found in inspecting pipes that have been pitch-troughed that the man who has put the pitch round the pipe has not spread it evenly. He has left just a small coating of pitch along one portion of the pipe and a thick layer along another portion of the pipe. By making a small cradle under the troughs, however, you can ensure that the pitch will flow evenly round the pipe.

Another point is that pitch or bitumen are not brittle providing you get them of the right softening point and penetration power. I should like to thank Dr. Beck again for his paper; I hope to have the opportunity of studying it very closely, because I am sure I shall learn a lot more from it.

G.P.O. Problems.

Mr. W. G. Radley (G.P.O.): I thank you for the privilege of being afforded an opportunity of speaking and especially for being asked to come here and listen to Dr. Beck's extremely interesting paper. Although I have not had very much time to study the paper there are one or two points which I should like to stress. As Mr. Bartholomew has already mentioned, our problem in the Post Office is not exactly the problem of you gas engineers. Our cables are not directly buried in the soil, so that our problem of measuring stray currents and leakage currents in them does become somewhat easier. I am very interested in the technique which Dr. Beck has developed. Although we have not tried anything like it ourselves I do feel that the principle on which it is based is absolutely the right one. I think that principle was first definitely put forward by the American Committee on Electrolysis in about 1921, when they said that the only real criterion by which the danger from electrolysis to a pipe or cable could be assessed was to determine the loss of current from that pipe or cable. Unfortunately, that is a method of measuring the loss of current from a pipe or cable which proves to be extremely difficult in practice. Mr. Bartholomew also mentioned the point that Dr. Beck found with some of his uncoated pipes and also with one or two of the coated pipes. I think that Curve 37 in Chart 3 actually shows that after a certain period of time the current leaving the pipe begins to decrease. I myself have tried to repeat some of Prof. Chappuis' experiments which were originally carried out by him with artificial soils made of sawdust saturated with metallic salts. Although it is quite easy to repeat his phenomena when using these artificial soils, I have not found it so easy to do that when using ordinary earth. We have had some experiments in hand in which we had two electrodes buried in a long box, but separated by about 4 ft., and with a potential between the electrodes. After a considerable period of time there was no sign of these phenomena—of the filaments of metal extending between the two electrodes. It may be that it would take place after a longer time, or it may be, as Mr. Evans has pointed out, that whether or not the phenomena occur depends entirely on the type of soil. I mention that again because although it has been referred to it is of the greatest importance. We should be in a position to classify the conditions as to whether this is going to happen or not, because whether it does or not depends on whether any point of damage in the protective coating becomes more or less self-sealing, or whether the conditions get worse and worse and the current of a milliampère or so goes on increasing and becomes magnified, rapidly producing a point of failure.

The President: Dr. Beck has intimated to me that he would prefer to reply in writing because he fears he may not easily be understood if he replies now. Dr. Anderson, however, will deal with a few of the points that have been raised in the discussion.

Reply to Discussion.

Dr. G. W. Anderson: I must apologize if I am not quite clear about some of the details that have been raised, because as you will imagine it is rather difficult to assimilate in a brief time the highly developed technique of this question of corrosion. I will, however, do my best to answer the main points raised, and Dr. Beck will later on reply in writing.

The point has been raised by Mr. Bartholomew as to the

application of Dr. Beck's method in practice. I am assured by Dr. Beck that his method can be applied quite easily to the pipes as laid in the ground. The electrodes can easily be applied to the pipes, and leads are then taken up through the street surface whatever it may be, and you can measure the intensity of the current, leaving or entering the pipes, as you please. It is not necessary to isolate a section of pipes or branches from the main because the electrode at the spot where the current enters the main is negative, and the points where it leaves the main is positive. Therefore, a point can be obtained where the entry of the current and the leaving of the current occurs. As far as the type of electrode is concerned, certain electrodes are now being applied which are free from polarization, and that, I believe, is an important point which may lead to important results both in the laboratory and in the field. Mr. Bartholomew also raised the question of the hypothesis put forward by Prof. Chappuis. Dr. Beck is entirely in agreement with the findings of the General Post Office, and has, in fact, mentioned the point in the paper, and suggests that the reduction in the intensity of the current is mainly due to the formation of the cement-like layers to which Mr. Evans referred. Dr. Beck also agrees with Mr. Evans that the exploitation of such protective coatings as inhibitors should be further studied, and, indeed, will be further studied.

The rotting of wrappings was mentioned by Mr. Masterman, and that point has been mentioned, although perhaps not very adequately, in the paper. Dr. Beck also agrees that troughing with suitable pitch or bitumen is a very satisfactory method of protection, but suggests that this troughing is expensive and that if wrappers can be found which will also be satisfactory they would prove to be very much cheaper.

Heating Buildings by Gas

By ARTHUR H. BARKER, B.Sc., M.Inst.C.E., M.I.Mech.E.

The PRESIDENT: We are much obliged to Mr. Barker for his paper. He has given us his very candid criticisms of present practice, and has shown how, in his opinion, improvements can be made. I am sorry that, although Mr. Barker's paper is provocative of discussion, there will not be sufficient time for us to hear all who wish to speak.

Mr. STEPHEN LACEY (Gas Light and Coke Company): As many of us know, Mr. Barker is an eminent heating and ventilating engineer who has applied scientific methods to the investigation of many of the complex heating problems with which his profession has to deal; he is particularly renowned as a pioneer of what we know as panel heating. Therefore, one pays close attention to what he has to say to the Gas Industry about heating buildings by gas. The paper is full of controversial matter, and although the time at our disposal is short, I should like to refer to local heating by gas. It is obvious to readers of the paper that Mr. Barker is a whole-hearted advocate of local panel heating, as exemplified by the apparatus he has described as the gas "Rayrad;" he believes that to be the ideal for which we should strive. His whole argument marches to that conclusion, and I think he makes out what appears to be a good case for local panel heating by gas, especially in regard to large, modern, steel-frame buildings, where the orthodox central heating is the normal practice to-day. My Company have had under test an installation of these gas "Rads," and while we feel that they are still in the experimental stage, we hope, with Mr. Barker, that the practical difficulties will be overcome, that the system will serve a very important purpose in the future, and that it will help us in the development of the use of gas in new buildings.

At the same time, I do feel very strongly that in making out a case for his ideal system Mr. Barker has done far less than justice to the well-established method of local heating by gas. If I may say so with respect, I think he has grossly under-estimated the part played by it in the heating of buildings, especially in the heating of existing buildings with flues—and, after all, those represent the overwhelming majority of buildings in existence. Consider, for example, one statement made by Mr. Barker about the gas fire. He says: "If this had been a solution satisfactory to the public the use of gas fires would have extended twenty times more rapidly than has been the case." Again, if I may say so with respect, this is a very loose statement. If progress in my own Company's area of supply had been twenty times more rapid than it has been, we should have about twelve million gas fires in our area to-day, and there would be about two gas fires to every room. [Laughter.]

The first of the three outstanding disadvantages of gas as compared with electricity is given by Mr. Barker as "The necessity for keeping it closely confined in a gas-tight pipe until it is completely burnt." Why did not Mr. Barker say that the chief disadvantage of electricity is the necessity for keeping the current closely confined to the wires? We know well enough that the current is much more likely to get out of its wire and get off the track than gas is to get out of its pipe.

FLUELESS HEATERS.

There are many of Mr. Barker's statements that I should very much enjoy challenging, but time does not allow me to deal with them all. But I should like to refer to what I conceive to be a serious misrepresentation of the actual facts with regard to closed heaters. Mr. Barker says: "It is not very easy to burn gas so as to produce no CO and no hydrocarbons." That is simply untrue; and there is ample experimental evidence in support of what I say. Anyone would conclude, from the paper, that flueless heaters have been forced upon an unwilling public by the Gas Industry. The reverse is the truth, however, for there has been, and is, an insistent demand by the public for flueless heaters, which is at last, I am glad to say, being met by the gas undertakings supplying properly designed flueless appliances instead of the shoddy appliances which have given flueless heating such a bad name. Since we have had properly designed flueless heaters available in our Company we have supplied, mostly on simple hire, about 60,000 of them; that is, within the last six or seven years. I repeat that they are supplied on simple hire, and if, as Mr. Barker suggests, they are not satisfactory, why are they not sent back? They do not come back; the number in use is increasing every day, and we get unsolicited testimonials from people who have installed flueless heaters in place of electric fires. I have collected a few of these testimonials, and I will read one, which we have received from a firm of estate agents. It states:

> We have pleasure in stating that we have been fully satisfied with the radiators installed at our offices, and have had satisfactory reports from our clients who have had work carried out by your Company on your recommendation."

I give that as an indication that the public are satisfied with good flueless heaters, in suitable circumstances.

I do think that Mr. Barker has passed very lightly over the capital cost, for example, of his ideal system; I should like to know more about that. I cannot see that system being installed in existing houses instead of the gas fire or the flueless heater. Again, Mr. Barker has made very little reference to the need for ventilating inhabited rooms, irrespective of the method of heating. ["Hear, hear."] I wanted to refer to a remark made by Mr. Barker, to the effect that gas fires might be useful where people had a preference for an incandescent fire. Is it not remarkable that the great majority of people do like the incandescent fire, and also that they appreciate the gas fire because it serves the dual purpose of heating and ventilating? It is not fair, right, or proper to compare the efficiency of a gas fire, which ventilates as well as heats, with the efficiency of an electric radiator, which only heats.

Finally, I should like to congratulate Mr. Barker on his paper, which I am quite certain will serve a most useful purpose in promoting discussion in the Industry on matters of vital importance to us.

HEATING PROBLEMS VIEWED FROM OUTSIDE.

Mr. G. B. HOWARTH (Chief Chemist, Newcastle and Gateshead Gas Company): Mr. Barker's paper is of particular interest to us, because it deals with heating problems from a point of view entirely outside the Gas Industry. It is not the first time that Mr. Barker's work has been of assistance to us in matters concerning gas appliances, and it is with some trepidation that I venture to draw attention to a few points on which his outlook differs from that of the gas engineer.

The removal of products of combustion by an electrically-driven fan helps to ensure the correct proportioning of gas and air in an appliance, but a more reliable method

is to deliver air under pressure from a positive blower. This has been found very satisfactory for certain industrial purposes where such an arrangement was necessary. The special devices required to ensure a safe shut-down when the electric power fails have worked successfully and have had ample opportunities of demonstrating their value. Nevertheless, the Gas Industry owes a large part of its prestige to its almost complete freedom from failure of supply, and a gas engineer would be reluctant to reduce the reliability of his gas appliances by the addition of auxiliary apparatus. The inconvenience that would be caused by an unexpected shut-down in a large and complex installation can hardly be contemplated.

The tendency in recent years has been to design appliances in such a way that they are capable of discharging their own products of combustion without external assistance. No difficulty arises unless in particular cases it is necessary to discharge products of combustion through a wall exposed to wind pressure. Mr. Barker's ejector device does little to effect an improvement in this respect, since the amount of air moved by the ejector is influenced by the wind pressure against which the ejector has to operate. The use of an exhaust fan may be satisfactory for a single gas appliance, but if several appliances were connected to the same flue, as Mr. Barker suggests, it would be extremely difficult to maintain the correct air flow through each individual appliance irrespective of the number of appliances in use at one time. As the various air inlets are in different parts of the building, the varying wind pressures at the different points would quickly make the scheme unworkable. Therefore, I am reluctantly forced to the conclusion that Mr. Barker's suggestions require considerable modification if they are to show any improvement on the methods at present in use in the Gas Industry.

Colonel W. M. CARR (Stretford and District Gas Board): Mr. Barker's paper, as he rightly said, is designed to be provocative. It gives us food for much thought, and I think that we as an Industry might well follow up the technique which he has laid out in the paper by very careful investigation of the whole of our own appliances as compared with the appliances used for competitive fuels, and from that point of view I think the paper is of the greatest advantage to our Industry. On the other hand, I must say that we cannot accept all that Mr. Barker says as being by any means right, nor can we accept the comparative costs that he sets forth as being truly indicative of the position as it applies to this country generally, because, of course, there are enormous variations in charges, depending on the situations of the gas undertakings in relation to the coalfields. But to take the lowest cost of electricity—in fact, the lowest figure at which it is sold—and to compare it with a fairly high cost of gas, is in itself rather misleading. Mr. Barker himself makes it quite clear in the paper that he does not wish us to accept these figures as being of universal application, but merely as illustrations; and *as illustrations* they are particularly useful.

THE WOLLASTON BOILER.

There are two points in the paper in which I am particularly interested, one being the reference to the Wollaston boiler, with which I had the privilege to carry out tests as far back as 1925. It is a very good boiler, but, as in the case of all boilers, we must not get the impression that it can work entirely on the cheapest grade of fuel. "Breeze" is a very wide term, and to-day breeze—when we are now dealing with small nut coke which is suitable for use in "Ideal" boilers and other closed domestic heaters—is perhaps the most valuable part of our coke. My experience with the Wollaston boiler was that the percentage of very small material—which I call the "dust"—in the breeze must be kept very low; otherwise, pockets were formed. A great disadvantage, which Mr. Barker points out, is the amount of labour required. We who are working producers appreciate the necessity for an even depth of fuel, and, therefore, that type of boiler requires very much closer attention in practice than a solid-fuel-fired boiler of another type; there must be constant attention to ensure that there is an even fuel depth, and there must be very careful balancing of the load. We know full well the trouble often caused in a shallow producer by the formation of what we call "chimneys;" in other words, draught holes through the fuel, causing chimneys and high CO_2 production. The CO_2 content of the waste gases should not be regarded, in such a boiler, as being indicative of the efficiency of the boiler, because it can be almost anything, depending on the working of the producer.

There is another point I should like to make in support of my statement that Mr. Barker's figures should not be regarded as being generally applicable. Those of us who are well situated are in a position to sell, and many of us are selling, gas for central heating purposes at very low rates. Due to the particular circumstances applying to the undertaking that I serve, we are able to supply gas on approved loads for central heating at a price as low as 3½d. per therm; this is entirely a matter of local circumstances. In this connection I have an interesting letter referring to an installation at a Council school in our area. This school was heated formerly by a coke boiler of the "Britannia" type—the ordinary sectional type of boiler—but this was taken out and a gas-fired boiler of the Bonecourt type was installed in its place, exactly the same heating system being maintained in the school. The total heat requirements were about 600,000 B.Th.U. per hour, the coke boiler being on the small side, having regard to its work; the total area of radiation in pipes and radiators approximates to 4400 sq.ft. Taking a heating season of 30 weeks, the comparison of net fuel costs for the season 1931-32, using coke, and the season 1932-33, using gas, was as follows:

Cost of Operation of Coke-Fired Boiler System.

	£	s.	d.
Coke (65 tons 5 cwt.)	74	8	10
Coal 7 tons 7 cwt.)	8	17	10
Firewood (18 bags)	4	2	6
	£87	9	2
Length of heating season: 27 weeks.			
Average cost per week	£3	4	9
The cost of operation of the gas-fired heater was:			
Gas, 6618 therms at 3¼d. per therm net	£96	10	3
Length of season: 30 weeks.			
Average cost per week	£3	4	5

It will be observed that this comparison is based upon the cost of fuel only, and does not include intangibles which cannot be assessed on a monetary basis, such as saving in labour, cleanliness, no storage of fuel required, automatic control, and adaptability to the varying demands of the English climate. These savings may be accepted as being very considerable.

Another factor which I must mention is that the school has been much better heated during the last winter season than it was when the solid fuel fired boiler was used, and the temperature charts showing the temperatures throughout the whole season at points furthest situated from the boiler constitute a wonderful record. The temperature has been the right one when the scholars have arrived at 9 a.m., but it never was when solid fuel was used.

The PRESIDENT: I am very sorry indeed to have to curtail this discussion, which is so interesting, but our time has already gone. I have a number of discussion slips, and I shall be glad if the gentlemen who wish to contribute to the discussion will submit written contributions, and Mr. Barker will reply in writing.

Mr. C. S. SHAPLEY, of Leeds (Past-President): I should like to mention at this stage that I have a report by Mr. Barker to the City of Leeds; it was on his advice that we installed gas in the Leeds City buildings. I hope he has not wrongly advised Leeds, and that he will stand by his report. I will submit my criticisms in writing, and will refer to certain parts of this report, which is very illuminating.

Centralized Manufacture and Distribution of Gas in Belgium

By GEORGE EVETTS, M.Inst.C.E., M.Inst.Gas E.

The PRESIDENT: We are very much indebted to Mr. Evetts for the valuable contribution he has presented to us. Mr. Evetts is Consulting Engineer to the Imperial Continental Gas Association and has been largely responsible for this very large installation in Belgium. We are indeed fortunate in having the paper, which will be a valuable addition to our "Transactions."

Mr. ARTHUR H. LYMN (Messrs. Gas Chambers and Coke Ovens, Ltd.): I should like to add a meed of congratulation to that which has been expressed by the President to the author for having prepared this paper. As the chief party concerned in Gas Chambers and Coke Ovens, Ltd., who carried out perhaps the largest contract for Mr. Evetts' Company in this undertaking, I was associated with Mr. Evetts a great deal in the course of the work and can speak personally of the enormous amount that he himself did. I think the Institution can consider itself fortunate in having a paper on what is really a very rational grid scheme.

In the paper Mr. Evetts refers to coke ovens as being specially able to use cheap coal. I am sure he will not mind my reminding him that gas chambers, and indeed, horizontal retorts, are also capable of using cheap coals. In the same paragraph he speaks of the blending plant which is usually associated with coke ovens as leading largely to this result. But surely blending plant should be usually associated with every kind of carbonizing plant! It does seem to me that to single out coke ovens specially for the application of blending is perhaps not quite justifiable. The author also suggests that the therms per ton cannot be equal to those produced by other well-known methods of carbonizing. We can approximate to the same results in coke ovens as in any other form of carbonizing plant, however, by merely using steam in the coke ovens; that is not new to-day. There is a plant in the Ruhr which is coking 2000 tons per day and has been using steaming for a long time.

Then the author speaks of the flexibility of coke oven plant, as though indicating that the plant is very special in that direction. I do not think we can agree with that view necessarily, if we envisage the application of the compound system to other types of carbonizing plant; I mean that we can heat them with their own gas at times, when the output is low; and if we assume a coke market—which I think will come back one day—it may be a very good way of avoiding a considerable amount of shut-downs in summer time, thereby, perhaps unfortunately for us poor contractors, causing the life of the plant to be longer. On the other hand, it is sometimes claimed that the other types of carbonizing plant are more flexible than coke ovens because they can be steamed, but, as I have already pointed out, coke ovens can be steamed also. Again, other types of carbonizing plant are built in settings, so that a set of 2, 4, or 6 can be let down in the summer time. If you really desire, you can have them in batteries of 10, 20, and so on, as in coke oven plants, and let these down. What I want to point out is that flexibility can be attained with almost any sort of carbonizing plant if one wants it.

RESULTS OF COLLIN PLANT.

The results of the Collin plant—for which my firm are the sole licensees—show that the heat consumption or heat in the ovens was in the region of 19 therms per ton; and indeed, that was the case in practice for months. On the other hand, in the author's summary of gas manufactured and coke for disposal, showing the maximum coke output combined with maximum normal gas output, there seems to be some inconsistency, though I am sure he does not mean that. He has taken the two batteries—*i.e.*, the whole coke oven installation—as one unit for the purpose of the calculations, and shows 23 therms per ton for heating the ovens, whereas probably the gross figure is actually about 21 therms for the battery I am referring to; the figures mentioned in the test results are net figures.

In Table I. there is a reference to a benzole yield of 0·8%. I rather think it is higher than that on the whole plant, and I do not know whether the figure mentioned has any special meaning. It is also interesting to note that the capital cost of the plant, as shown by that Table, seems to approximate very closely to that given in Mr. Hunter's paper, but Mr. Hunter did not state whether his figure covered the whole of the bye-product plant and the gas producers. I imagine that it did include them; the bye-product plant in that case was not quite so complete as that which Mr. Evetts is dealing with. Then Mr. Evetts mentions that the bulk of the work had to be done in Belgium. That is perfectly true; but British sub-contractors were employed wherever possible. However, 73% of the work was done by Belgian sub-contractors. Reference is made in the paper to the difficulty of bringing material in and out of the works. I think the Imperial Continental Gas Association—or rather, the Cokeries du Brabant, which is a subsidiary—is very much to be congratulated upon tackling an enormous job. Think what it means. My firm had about 450 of its own men working, and there were about 400 sub-contractors' men, and an enormous amount of material had to go in to get the job completed in twelve months. The fact that they got through as they did speaks volumes for their organization.

Mention is made of the fact that the coal tower, supplying coal to the ovens, holds up the coal, so that its capacity is reduced. That is true to some extent, but it has a shape which was not chosen by the contractor. It happens to be small at the top and bigger at the bottom, and naturally, it does not contain as much coal as one would like to see it capable of holding, having regard to the amount of money involved in its construction. Then there is reference to the size of the benzole scrubber. It is a very big scrubber indeed, of 11 ft. 6 in. diameter and over 100 ft. high. It is a static washer, and actually it deals with a great deal more of the gas, quite apart from the other battery.

PROFIT ON SULPHATE OF AMMONIA.

With regard to the indirect ammonia recovery, I think the origin of that was that the plant would be able to make other products if the sulphate of ammonia market "went west." In Belgium they are getting £7 10s. for sulphate, and paying about 30s. for sulphuric acid, and they are making sulphate of ammonia at a profit. In Table III. there is a figure of 4·11% as representing moisture content of the coke, but that had nothing to do with the test; for special market purposes the Company was rather over-quenching. Generally the moisture content is in the region of 2%.

A matter to which the author did not refer, in reference to Distrigaz, is that one of the big works there has a synthetic ammonia plant, and they are delivering gas not merely to this grid, but also to the town of Mons and its environs. They have to deliver two grades of gas—one of 4000 and the other of 5200 calories. The former they get by breaking down the coke oven gas by means of the waste gas from the synthetic ammonia plant, which consists mostly of CO_2 and nitrogen, and from another portion of the gas, from the fractionating plant and the synthetic ammonia plant, they boost up another lot of the gas to 5200 and send it to Mons. Finally, with regard to the suggested visit to Belgium, I am sure that those who can find the time to go there will be interested not merely in the coke oven plants; the whole undertaking there is one of intense interest, and I do hope that a good many of the members of the Institution will find time to go.

Mr. C. H. CARDER (Rio de Janeiro): The paper is interesting from many points of view, but I find particular interest in the distribution line, because in 1931 I put down 10½ kilometres of 14-in. high-pressure distribution line as part of a unit distribution system and not as a trunk system. I was not able to keep my costs down to 40s. per yard, but, naturally, the conditions will vary according to the country in which such a line is laid and the class of ground. Therefore, I should like to ask Mr. Evetts what was the class of soil in which the pipe referred to in the paper was laid, and whether he was able to take the pipe across country or whether he was compelled to adhere to macadam roads. For the purpose of comparison with Mr. Evetts' figure I would say that the 14-in. pipe which I provided cost about 59s. per yard in place; of that, approximately 32s. per yard was for the unwrapped pipe delivered in Rio de Janeiro. A good part of the pipe line had to be laid through the streets of the City, and the greater part of

the district traversed was paved with sheet asphalt laid over concrete. There was a cover of 1 metre in practically every case, and that corresponds roughly with the cover mentioned by Mr. Evetts in the paper. The conditions as to tightness and test were also apparently approximately similar. We had to wrap the pipe ourselves, and we used double hessian wrapping with bitumen coating. Long sleeve inserted joints welded solid were used, and the test pressure was 80 lbs. per sq. in. over the whole length; it was tested in sections as assembled, and then the whole line was tested after laying.

With regard to the compressing plant in Belgium, I do not see any reference in the paper to any gas drying equipment; it is rather fashionable nowadays, although I have not any of it. I should like to ask whether it was found desirable, or perhaps even essential, to include any after-coolers on the compressed gas line. Again quoting from my own experience, I found that the after-coolers between the compressors and the receiving drums for the high-pressure gas line were of enormous advantage. Local conditions enter into the problem, because during the tropical summer we would be dealing with the gas saturated at 42° C. at the inlet to the compressors, and a temperature at the compressor outlet of 115°, 120°, or even 128° C. when compressing to 22½ lbs. per sq. in.

Finally, I should like to call attention to what appears to be a misprint in Part III. (2), dealing with the quality of the gas. I think that 477 B.Th.U. is at zero 760 mm., because if that is a dry gas the equivalent is approximately 449 B.Th.U. at 60 and 30.

Mr. R. W. Hunter (Gas Light and Coke Company): I should like to add congratulations to Mr. Evetts for his most interesting paper. As a matter of interest, I would mention that the cost of producer gas per therm, as shown by the paper, works out at almost exactly the same as our figure at Beckton. I make it 1·26d. per therm, charging ourselves for coke at 15s. and breeze at 5s. It is also of interest to note that the total number of men employed on his works is 420, for an output of approximately 20 millions; the total labour at Beckton, when working on full load, would be about 2000 men, so that the proportion is almost exactly the same. We have the advantages of the concentration of manufacture in large works, as Mr. Evetts has provided in Belgium, as contrasted with manufacture in a number of smaller and older works. It is difficult to compare the working results at Beckton and in Belgium, because the types of coals used are not comparable. Mr. Evetts is using lower volatile coal, and the therm output is not comparable with ours. To an extent that is affected by modifications in the design of our ovens, but we have certainly higher top heats than those indicated in the paper. We have certain little troubles with naphthalene which come in its train. The low sulphur compounds figure of 15·4 grains per 100 c.ft. is rather surprising, and I do not understand how that was obtained.

We wondered whether the high shatter test figure of 95% for the coke is popular with the general customer. I know, of course, that the type of domestic stove used on the Continent is very different from that used in this country, and no doubt that affects the coke market very much. The prices obtained for coke are better than we can hope for at Beckton. The price of coal also, of course, introduces a variation which renders it very difficult to make comparisons. I do not see a reference to the degree of fineness to which the coal is crushed; we crush down to 80% through ⅛-in. mesh.

With regard to the " Connersville " meter giving trouble due to the momentary cut-off of the fuel gas supply, is that because there is no fuel gasholder to balance out the supply and to tide over the change-over period?

Cost of Loop Main.

Mr. R. J. Restall (Stalybridge): While I was at Burnley we constructed about seven miles of high-pressure gas main. Mr. Evetts' paper shows that in the Grid system in Belgium there is a loop main from Mons to Tertre, *via* Wasmuel. It seems to me that it is rather an expensive form of construction to put in that loop. If it is a 20-in. main I suppose it would cost somewhere about £30,000—I think it is about nine miles long—and I should be glad to know whether there is any factor which would justify that expenditure. The district from Mons. to Tertre is merely agricultural, and is quite flat. Also, perhaps Mr. Evetts would be kind enough to say if any difficulty was experienced in getting a high-pressure main from Koekelberg to approximately the centre of Brussels—*i.e.*, to the Saint Gilles station. The pressure there, I think, is higher than that used in England, and Mr. Evetts might be able to give help to those of us who have had or may have to carry out very high pressure work in the towns.

With regard to the amount of gas per mile of main in Belgium as compared with the Ruhr district, the latter, I think, is a very large area, whereas this Grid line in Belgium is comparatively small. I suppose the price of gas, settled on the price of coal at £1 per ton, is justifiable on the Continent, but it does not obtain in England, I think. I should like to ask also whether a lot of condensation has been experienced at the points where " sinkers " are used, and if so, how it is dealt with.

It is stated in Part III. (4), which deals with agreements with consumers, that they have to declare a minimum and maximum figure. The figure of consumption, of course, is influenced a good deal by the weather and industrial conditions, and I should rather like to know if that method is considered fair to the consumers.

Mr. J. H. Clegg (Burnley): I notice that the coke oven gas main in Belgium is laid wholly below ground, and I wondered whether the promoters of the scheme have considered the possibility of laying a part of it above ground, because by so doing one can effect considerable reduction of cost, and the only serious disadvantage which I have experienced in laying mains above ground across country is the great variation in temperature of the gas at the point of arrival. I notice with interest the precautions which were taken to prevent electrolysis of the main. It is very necessary to take precautions, and in our particular case we sectionalized the various lengths of the main by insulating media. I was interested to note also the specification for the analysis of the gas to be delivered, but I cannot agree entirely with the specification with regard to a maximum of 4·4 grains of naphthalene per 100 c.ft.; I have found that ½ grain per 100 c.ft. is quite sufficient to cause trouble, and even traces, in their cumulative effect, can cause quite serious trouble if precautions are not taken to ensure that there is no collection at any specific point.

With regard to the purifiers for gas, Mr. Evetts mentions that the capacity of the purifiers is very large as compared with English practice. He does not give the reason for this, but probably the amount of sulphur in the original coal is much more than that with which we are accustomed to deal. The coke oven gas we purify contains a maximum of 250 grains per 100 c.ft., and in those circumstances we do not require the large purifying capacity that has been laid down in this instance. We are indebted to Mr. Evetts for having put forward the practice obtaining in a modern installation of this kind in another country, because I am convinced that there will be more development in the way of inter-communication between town and town by small-scale Grid supplies in the future.

Mr. F. H. Robinson (Harrogate): Has Mr. Evetts experienced any difficulty with moisture at any distance from the ovens? Before we commenced our scheme the opinion was freely expressed that syphons were quite unnecessary in high-pressure distribution. But I was not easy in my mind, so that I had syphons installed in the usual way, and I am very glad that I did, for we have moisture carried as far as three or four miles on a pipe line. Again, has he experienced any trouble with the fine oxide of iron on the inside of the mains? We have found that the trouble has been the greater where the mains have been lying at the side of the road for some little time before they were laid. After the pressure test, of course, we get a lot of moisture out. Air is fed into the mains at high pressure, fully charged with moisture, and water is deposited in the pipe; then the pressure is released and the water left behind, and that seems to cause slight corrosion on the interior of the pipe line. Further, we have often found that where a branch is taken off a main, if that particular branch is giving a rather large supply and the main itself is going ahead rather less, a sort of eddy is formed and that a deposit of rust slowly accumulates, just as in a stream there is a deposit of mud on the inner side of a bend; the eddying causes a deposit of the fine dust in the quieter parts of the gas main.

With regard to the cost of transmission, I was interested to notice the figure of 1½d. per 1000 c.ft. Our figure, working from 6 to 9 lbs., works out at 1·59d., which includes capital charges, maintenance, and cost of compression. This Belgian scheme provides for feeding in gas at very remote points, and I should like to know how they balance the load at the respective coke ovens. Finally, I should like to thank Mr. Evetts for a most interesting paper, which is full of matter for reference.

The Author's Reply.

Mr. Evetts, replying to the discussion, said: Mr. Lymn raises one point of criticism—that the use of cheap coals is not necessarily associated with coke ovens. Of course, I agree with that, and I think that in the paper I drew attention to the advantages which are not confined to coke ovens, but they are nevertheless advantages of coke ovens. I think that answers more than one of the points raised by Mr. Lymn. I was interested to hear him say that steaming is used in one large coke oven plant with which he has

been associated, or of which he has knowledge, and I should be glad to obtain some further information from him about that at some future time. Mr. Lymn was quite right in saying that coal-blending is not inherent in coke oven practice, but the point I tried to make is that hitherto in gas-works we have not considered blending as an essential part of our process. Coke ovens have invariably included a blending plant as being a necessary part of the process, and, in addition to pointing that out, I was endeavouring to stress the advantages of blending.

Again, Mr. Lymn referred to the flexibility of coke output when operating the works to a fixed gas output; he said that this can be done also by other methods of carbonizing, and that it was not necessarily a prerogative of coke ovens. I agree with that also; but I do want to emphasize that the flexibility of coke output is associated with an absolutely fixed gas analysis, and that, to my mind, is the very big attraction of this compound heating, which admittedly might be extended to other forms of carbonizing plant, but is not in fact. That was my object in stressing this aspect as a favourable one for coke ovens.

Then Mr. Lymn drew attention to the apparent difference between the figures for the heat consumed in ovens, as shown in calculating the output, and those which actually emerged as the result of tests. In Sub-Section (4) of the Summary of gas manufactured and coke for disposal, I was setting down the day in and day out working in order to estimate the amount of coke which can be produced by various methods of heating the ovens, and I used an overall figure of 23 therms per ton. That, as Mr. Lymn points out, is the gross figure, whereas the test result is the net figure, which makes quite a difference, and, of course, I had to consider a combination of two batteries of ovens, some of which may not be working at absolutely full capacity, and the estimates I have made in the summary include simply round figures for the purpose of calculating the flexibility of coke ovens. Then he refers to the figure of 0·8%, representing the benzole yield, and he reminds me that, judging from the results of the tests, the benzole output is a little more. I agree that the output is a little more; but again I would remind you that Table I. is an estimate prepared before the plant was put up. We were considering a new plant, and therefore, we wished our estimates to be on the conservative side. Mr. Lymn was quite right when he referred to the disadvantages under which the contractor had to work when constructing both the first and the second units. He made reference also to the employment of Belgian sub-contractors. We must remember, of course, that if we were in England and had a German specialist we should ask for as much English material or sub-contracting work as possible. The Belgians have done exactly the same thing.

Shape of Coal Storage Bunkers.

With regard to the shape of the coal storage bunkers, we thought, both in the first and second batteries, that that shape was a good one from the point of view of preventing the hanging up of the coal, and in fact, the real cause of the hanging up was the use of coal with a much greater percentage of moisture than was ever visualized at the time the plant was built. We had also to change our coal, because at the time the plant was first built we were using a much greater proportion of English coal. The quota system came into operation in Belgium, and unfortunately our quota, when the whole works was going, worked out at a comparatively low percentage of English coal, so that we got something like 15% of English, the balance being Belgian and German, some of which contains rather a large percentage of moisture. Then Mr. Lymn drew attention to the fact that sulphate of ammonia manufacture is a very profitable business in Belgium. It was with the idea that we could ring the changes in regard to ammonia products that we went in for this particular form of ammonia plant.

Coming to his point that in the test results, as shown in Table III., the moisture content of the coke is shown as 4·11%, I have made a note at the foot of the Table that the figure is high owing to a temporary defect, which was afterwards rectified. That is literally true; it was due to the clogging of the spraying pipes. As a rule we get the coke out with a moisture content of 1·1%. It was not the market condition which prompted the high moisture content of 4·11%, but the blocking of the sprays, and it was our fault entirely.

Mr. Carder said he would have liked to have been able to purchase a pipe of the diameter of this pipe for 40s. per yard. It is quite true that the pipe was very cheap to start with, and the soil was easily worked, for it consisted practically of sand the whole way. The whole of it was laid in the roads; you probably know the Continental method of setting; it is what they call pavé—*i.e.*, granite setts set in loose sand—and in addition there was a certain amount of verge work. Incidentally, it was because the pipe was so cheap that we did not consider any method other than below ground; we did not consider seriously an overhead pipe line, or going across country. Taking everything into consideration, including the fact that our business lay along the main roads, we kept to the roads all the way. We did not depart from them in order to take short cuts anywhere. Reference was made also by Mr. Carder to gas-drying, and to the difficulties with regard to moisture generally. The compressors in the Belgian installation are water-cooled, but there are no after-coolers; it may be noted that the pressures are not very high, and I can say definitely that we do not get moisture trouble there.

It is interesting to hear from Mr. Hunter that the amount of labour employed in the Belgian plant squares up very well with the amount employed at the Gas Light and Coke Company's Beckton Works; but we can make another 20% of gas with practically no addition of labour, and that applies almost equally well to Beckton. The working results of the Belgian plant cannot be compared exactly with those of the Gas Light and Coke Company, as he points out, in view of the low volatile content of our coal. We have practically no naphthalene trouble at all. Frankly, I cannot understand why our specification for gas distributed to customers contains such a high figure as 4·4 grains of naphthalene; it is usually well under one grain. With regard to the sulphur figure of 15·4 grains, I ought to have qualified that. There is no sulphuretted hydrogen against that; it is only sulphur compounds.

Demand for Domestic Coke.

Coming to the shatter test and the coke generally, we find that there is a very great demand for coke for domestic uses, generally sizes from ¾ in. to 1½ in., and there is a demand in rather less degree for a size from 1½ in. to 2½ in. It will be realized, of course, that in Belgium the closed stove is the usual medium of heating; there are no open fires there, and we have found that this metallurgical coke, properly graded, and of the size from ¾ in. to 1½ in. is in very great demand. Indeed, the demand is so great that we have provided special storage for it during the summer months so that we can begin to sell it as the demand arises. I have drawn attention to that in the paper.

The degree of fineness to which the coal is crushed is, below 1 mm. (*i.e.*, below 0·04 in.), 50%; from 0·04 to 0·12 in., 20%; from 0·12 to 0·18 in., 12%; from 0·18 to 0·3 in., 12%; and above 0·3, 6%. We experienced a certain amount of difficulty at first in getting this coal crushing right. We made experiments, taking bars out of the crushers and running crushers at different speeds, and at last we have a satisfactory fineness for these coals, and the result is that we get this 16-in. oven off in about 16½ hours. A very interesting point with regard to the system was raised by Mr. Restall when he suggested that it appeared to be uneconomic to provide the loop main through Mons as shown by the map in Fig. 1. As I was not responsible for the laying of that part of the Grid, however, I cannot give the answer. It certainly looks extravagant, and I will make it my business to find out what the reason was for that particular loop.

As regards high pressures in Brussels we have had no difficulty at all. Of course, the Imperial Continental Gas Association had not the centre of Brussels within its concession. It included only the suburbs, and, therefore, these pipes did not go right through the heart of the city. They do pass through a fairly congested part, but the pressures are not very high. We have had no practical or political difficulty whatever in the laying of these pipes. It is admitted that the people in the Ruhr are not so favourably situated as those in Belgium, in the sense that the towns and the industries are not so closely packed. I merely introduced this figure of 85 millions per mile as against the figure of 48 for the Ruhr to give you a mental picture. I did not intend to suggest that the figure for the Ruhr ought to be greater, or that we are doing anything very wonderful in getting 85. One does not expect the same degree of density in the Ruhr schemes.

The price at which the gas is sold to the consumers of the Grid is, of course, rather favourable to them to-day, having regard to the low price of coal; but, generally speaking, the coke market has improved during the current year, with the result that prices are economic to-day.

Syphoning.

The point raised with regard to syphons is very apt; Mr. Robinson was very wise to provide syphons in his high-pressure main, and not to listen to the suggestion that they were unnecessary. My usual experience of these high-pressure pipes is that, at any rate for the first two or three syphons, there is quite a lot of moisture, whatever the degree to which the compression may be carried, whether it is light or heavy; but the amount of moisture tails off after the first two or three syphons. In this particular pipe line the condensation has been less than I have hitherto experi-

enced; we have practically no difficulty, and even at the "sinkers" where the pipe line goes under water courses, we have not met with difficulty, but there are syphons installed in case moisture collects at those points.

Then reference has been made to the difficulty that might be experienced as to the quantity of gas the consumers will take from the Grid, and whether there is any flexibility in that respect. These conditions in the agreement with consumers may appear to be a little harsh on paper, but it must be remembered that these buyers are, generally speaking, existing gas undertakings, and therefore carry their own proportion of storage, exactly as would a normal gas-works. Therefore, they have the same obligation towards the Grid as they would towards their own works foreman in a gas-works. We look at the holder, consider what day of the week it is, and decide at 5 p.m. that we will half charge or drop certain retorts, or put on the water gas, or decrease it, and so on. The man who is taking gas from this Grid looks at the problem in exactly the same way, and telephones the headquarters of the Grid, and says that he wants a certain quantity of gas on the following day. The answer to the problem, of course, is flexibility of the storage at the consumers' own works; I should have emphasized that a little more perhaps.

With regard to electrolysis, I have not the details of all the precautions taken in this installation, but I know we did have special insulating joints for precaution against electrolysis. Then Mr. Clegg referred to the size of the purifiers at the coke oven works. We have much more sulphur in the crude gas than there is in that which Mr. Clegg deals with; and the reason why the area covered by these purifiers is so small is that they are built up, and are really a series of purifiers one on top of the other. We did not follow the usual custom of having three or four relatively thin layers of oxide. The purifiers are in effect four purifiers, one on top of the other, with one thick layer of oxide, and no difficulty has been experienced.

I think I have explained the balancing of load by informing you that the buyer of gas from the Grid carries his own storage—and, of course, a manufacturer knows, at 4 or 5 o'clock in the afternoon, what would be the demand for the following day.

(Some drawings of the Belgian plant were exhibited at the Meeting for the information of the Members.)

The Development of Gas as an Industrial Fuel

By JOSEPH E. WHITE,

Newcastle and Gateshead Gas Company.

The PRESIDENT: We are very much indebted to Mr. White for this valuable paper. I should like to express our thanks to him, and also to the Newcastle and Gateshead Gas Company for having allowed the paper to be read, giving as it does so much information which will be of use to those who are engaged in the industrial gas business. The subject is one of special interest to the Industry at the present time, and we are glad to have all the information we can obtain with regard to it. I am sure Mr. White's paper is of very great value.

Dr. C. M. WALTER (Birmingham): I think it is very opportune that at this meeting we should have a paper on the development of gas as an industrial fuel; especially should we be proud of the fact that we have such a paper from a representative of an undertaking which has in no selfish manner, and under most difficult conditions of trade, set out to develop business of this kind, not only in its own area of supply, but also in such a manner as to give assistance to other undertakings at very reasonable rates. This, I think, marks a milestone in the furtherance of the use of gas throughout the whole country, because we know that at the present time considerable impetus is being given to this side of the gas undertakings' business by the three national bodies which are at present co-operating with a view to establishing industrial centres throughout the country.

Mr. White, in his introductory remarks, refers to the necessity for an undertaking to organize itself if it is to make progress in this industrial business. I think that all of us who have had experience of the development of an industrial load will agree that we cannot hope for potential consumers to come to our doors; we must first organize a section to deal with that work and must staff it in such a way as to get the potential user interested. Secondly, we must be able to supply gas at economic rates. Perhaps this latter is the most important consideration in the development of an industrial load. We know that at the present time undertakings serving industrial areas are doing their best to establish tariffs which are attractive to the industrial user, and I am sure that, as Mr. White points out, a multi-part tariff will do much to assist in that way. But whatever form of tariff is employed, I think it will be necessary that the large user shall be called upon to pay only a fair contribution to standing charges, rather than any unreasonable amount. A difficulty in the past has been to assess accurately what that contribution to standing charges should be.

In Part II. of the paper Mr. White refers to the recent proposals of the three national bodies in regard to the establishment of centres throughout the country, and I am sure we are all looking forward to the time when a large number of these centres are in active operation. We hope the time is not far distant when the co-ordination of the work of these centres is in full force.

ADVANTAGE OF THE TAX ON OIL.

Charges are given in Table II., and while many of us would like to be in the happy position of supplying gas at somewhere about 2½d. per therm for large supplies, I am afraid some time will elapse before we can get down to such a low figure. Still, we have to remember that in some of these localities, where coal can be obtained at a very low price, it is essential that gas should be obtained at a correspondingly low figure if it is to be competitive We are all glad to have the advantage of the tax which has been imposed on fuel oil. I feel that, although this will be ultimately of great assistance to us, we must not take it for granted that we shall get automatically for gas the loads which are at present held by fuel oil. We have to go out for it and work hard to get it—and I think the tax of 1d. per gallon on fuel oil is already actually making users think in terms of nationally-produced fuels. We have now the opportunity to make the best of it, and I am sure that if we do so we shall increase our consumption very considerably, even though it may not appear economic, from the point of view of B.Th.U. cost, to employ gas in favour of fuel oil. In dealing with the consumer we must stress the efficiency of its application, rather than B.Th.U. cost alone. The author refers to certain industrial applications of gas, including its use for heavy forgings, and he mentions 13,000 c.ft. per ton as being the consumption for certain types of forging work. I think this is interesting, in so far as it shows at once the enormous advantage to be obtained by gas from the point of view of efficiency of application; it is obvious from these figures that the efficiency is many times that which can be obtained with coal.

I attach considerable importance to Form C in the appendices to the paper, where the author sets out the details which have to be filled in by sales representatives, not only in respect of new business, but also in respect of business lost. It is important that we should have very accurate records of business lost, because generally it is very difficult to find out how and why business has been lost if it is not properly recorded. It is often said that we learn more by our failures than by our successes, and I think that when we come to revise our tariffs at any time it is very important that we should have available full details of any business which has been lost to competitive fuels.

I should like to congratulate Mr. White on the work he has done in connection with the use of gas for vehicle working. I have had the pleasure of seeing a lot of the work that has been carried out at Newcastle. I am sure he has lost no time in remedying the defects he has referred to, and I trust that he will soon be in a position to get results with gas similar to those obtainable with petrol.

In conclusion, I should like to congratulate Mr. White on this interesting paper, which I am sure can only act as a stimulus to us in applying gas as an industrial fuel.

THE SMOKE CURSE.

Mr. W. BROWNHILL SMITH (Chairman of the Glasgow Gas Committee): It is appropriate that the papers by Mr. Evetts and Mr. White should be considered during the same session, for they have so much in common. There

is a greater future than I think any of us have seen for gas as an industrial fuel. Yesterday morning, when looking over the roof of the magnificent hotel which is your headquarters in this City, for half an hour, a continuous stream of smoke of medium density rose from a chimney in the middle of the highest part of the roof. Again this morning, between 7.30 and 8.30, I look at it at intervals of a few minutes, and that trail of smoke from highly bituminous coal was coming out of the chimney, destroying the beautiful architecture. The hotel is built of a fine white stone, but it is not quite so white to-day as it was when the building was opened a few years ago. Looking around Liverpool I see many industrial chimneys pouring out regularly streams of smoke from bituminous coal. For stopping that I would look to the industrial load of a gas undertaking. You can give the factory owners a chance of three methods of stopping it. First, if they want a solid fuel, they must not use bituminous fuel, which throws impurities into the air. If you shake up your processes and look into the matter carefully you can give them a solid fuel so good that they would never look at a bituminous fuel again. Secondly, if they prefer fuel oil, which is adopted in many large buildings in London and some other cities, for central heating, because it has many advantages—it is automatic and is under very good static control—you can give them a good oil, produced from the coal that you carbonize for your smokeless fuel. But the third method, which is better than either of the other two, is to give them a good supply of very cheap gas. So that from the one coal, which they are abusing, you can give them fuel in any of the three forms I have mentioned. If they want to use oil, then, instead of buying it from abroad—as you sometimes do in your own undertakings—they could buy it from you, and you will become, not the buyers, but the sellers of oil, not only to yourselves, but to the great industries which should be running their factories without producing smoke. And you can do it.

In 1922 the Fuel Research Board, under the Presidency of the late Sir George Beilby, furnished to the Government a report which was entitled "The Therm." It was stated in that report that probably in the future electricity would get the lighting supply and a certain amount of the power supply of Britain, but that the production of great quantities of potential heat energy should rest with the gas undertaking. During the eleven years that have elapsed, not much has been done. It was praised by a few, criticized by a number, and ignored by nearly everybody. The production of potential heat energy in an economic form should and does rest with the gas undertakings. But they must change a little. They must not do everything to force the greatest quantity of gas out of every ton of coal, now that solid fuel and oil are coming into their own. The demand is there and the supply should be there also.

The Report of the Royal Commission on Coal, in 1926, was circulated; but that also was very much ignored. It was stated that if the very many millions of tons, such as was mentioned in the President's Address, were carbonized by the gas-works, we should produce almost enough oil from our own British coal to supply our own undertakings.

Some 23 years ago I was asked to address the North British Association of Gas Managers. At that time they were very nervous about the competition of electricity. I told them then that they had a great future before them, if they would make and supply great quantities of gas of lower illuminating power and at very much lower price, and, at the same time, a good smokeless fuel. We knew nothing about oil from coal at that time; but now that extra advantage has been added, and I congratulate you on having the papers which are presented to-day. We have got to do as was done with electricity, to some extent, but not to the same extent; we have to concentrate upon the most economic science, the production of gas, and you will get results as great for power production. In many cases you can under-cut electricity. If you get the cost of gas down, the production of power from gas is a splendid paying concern; even on a small scale every motor-car on the streets has a gas engine. Why should not all the factories in Britain have little gas engines just as convenient and as economical as the little electric motors that are spread over the country? I predict that, on the lines suggested in the papers, you have a great future. You can sweep the smoke from Britain, and you can make it pay you and pay the colliers who are now wanting work.

Rally Round the Centres.

Mr. H. D. Madden (Cardiff): Mr. White has asked me if I will speak on this paper because for some time past we have been in very close touch. I think the paper is very appropriate at the present time, when trade and industrial gas is being very closely considered. As a member of the Joint Committee of the Institution, the National Gas Council, and the B.C.G.A., on this subject, I am in fairly close touch with the work that is going on and appreciate the necessity for it, and I should like to appeal to the whole Industry to rally round those Centres which have been set up for trade and industrial gas development. May I say, too, how much we are indebted to the Newcastle and Gateshead Gas Company for the help it gives to those centres which are trying to stagger along under very great difficulties. I have obtained information from Newcastle when I have required it in a hurry; when I have not been sure about any process I send a telegram to Newcastle and the information is sent at once. I would like to say the same of Birmingham, and both Newcastle and Birmingham have placed the Industry under a debt of gratitude to them for the pioneer work they have done. [Applause.]

It may be thought that the setting up of centres is an easy matter, but I can assure you, Mr. President and Gentlemen, that it is not. My experience of it is that you have got to get the right men, and I fully confirm Mr. White's statement that you want men with sound mechanical training. Men who are dealing with industrial gas should be very well mechanically trained and should be at least up to the B.Sc. standard in technical knowledge.

Speaking of our experiences in the last two years, we have had inquiries sent to us from the contributing undertakings—questions which are most difficult to deal with. However, as we are gradually getting data we are finding that an inquiry which looks at first sight very difficult turns out to be very simple, because we have not only our own data, but we have an interchange of information between Birmingham, Newcastle, and the other centres. A problem was put up by Mr. Canning, of Newport, with regard to the use of coal gas to cut 6-in. square bars. At first we could not do it as quickly with town gas as with acetylene, but as the result of some manipulation we were able to carry out the work more cheaply, and as expeditiously, with our gas as with acetylene cutters.

Use the Gas Unit.

I should like to refer also to the tax on oil and its effect upon consumers who have been using very large quantities of oil for heat treatment. I can only emphasize what Dr. Walter has said—that you must have a right price, and gas will do the work. I have been asked recently to quote a price for gas to a works which has been using very large quantities of oil. The proposition was put to me by a man who said that he was putting in two electric furnaces. When I told him the price per unit at which we would supply gas he was rather staggered to think that he could buy it so cheaply as against electricity. I do advocate that you should use that unit charge where you have to compete with oil and electricity, for I am sure it is very advantageous to get a consumer minded that he can buy heat units from us on a basis comparable with that of electricity.

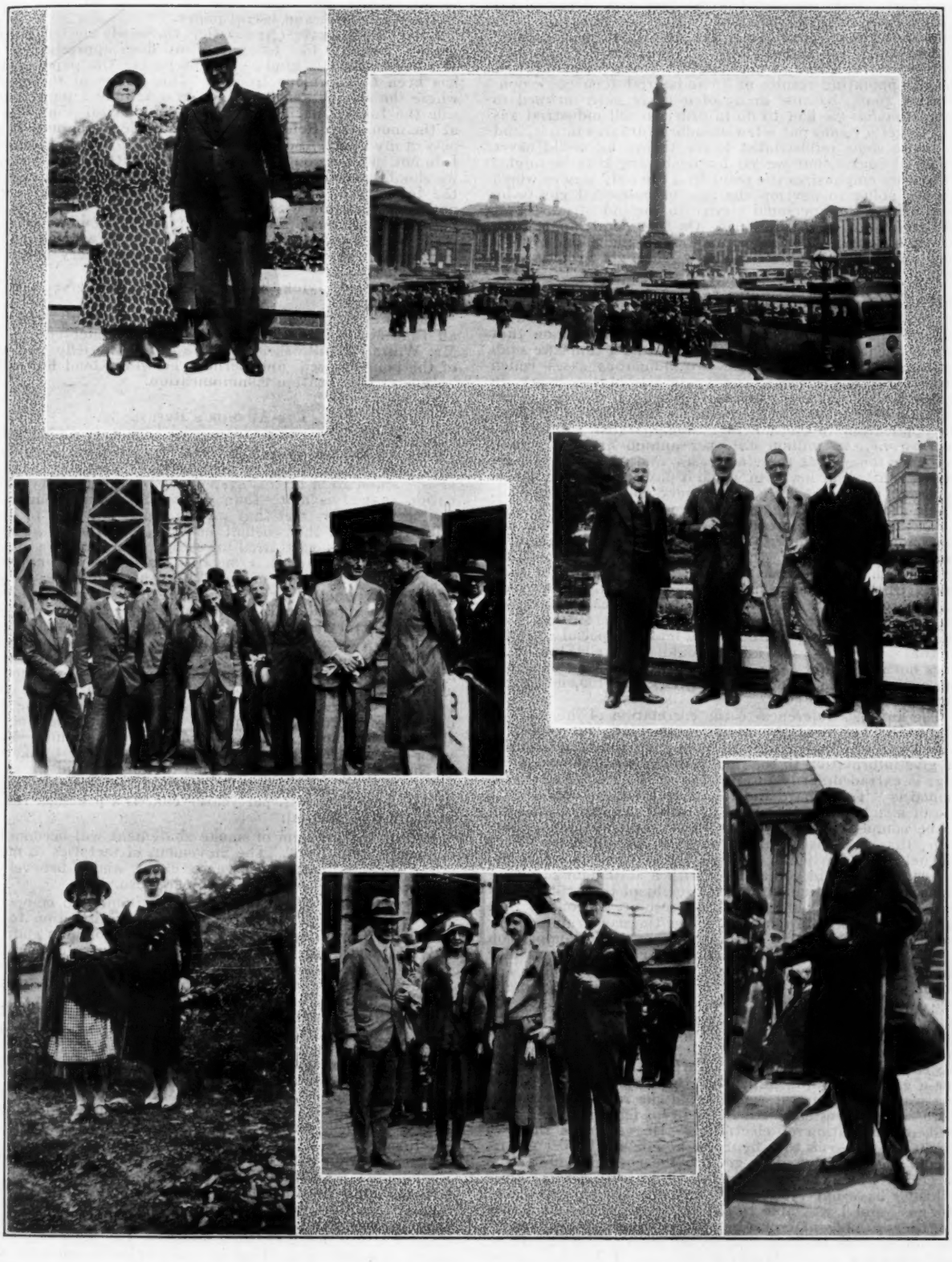
In conclusion, I would congratulate Mr. White on this paper, which will be most useful to us individually and to the Industry as a whole.

Need for Standardization.

Mr. C. Le Maistre (Director and Secretary, British Standards Institution): I appreciate very much the opportunity of saying just a few words to gas engineers. For thirty years I have been connected with the work of standardization. I was very much impressed by this paper, dealing with the development of gas as an industrial fuel; I have felt for many years that this was the line which presented enormous possibilities to the Gas Industry. I am also very interested to see that, after the introduction, Mr. White deals straight away with national co-operation and organization. Your sister industry—the electricity industry—attributes in large measure the tremendous success it has enjoyed during the last twenty years or so to national co-operation in standardization. I feel that in any organization that you set up in the Gas Industry for national co-operation with a view to getting into closer touch with the various branches of industry which might so well make use of your fuel and so help our country in these difficult times—and more difficult, I think, before it—you must consider the question of standardization from the mechanical point of view largely. A good gas engineer, as we have just heard, should be a mechanical engineer. The mechanical engineers were the last, really, to understand the meaning of "standardization," but during the past five, six, or seven years they have been making considerable progress. I feel here that you gentlemen can make just the same progress and can help enormously in the reduction of the cost of your apparatus if only in your Regional Committees you explore the ground and consider whether you can obtain agreement on some scheme of standardization which would be of benefit to every gas engineer throughout the country.

The Gas Industry I look upon as the most progressive industry in the country. I have watched it through the eyes of Sir David Milne-Watson—and I do not think I can find better eyes through which to look at the Industry, for I have never found a broader gauge man than he; he has been of the greatest assistance to our national organization of standardization. Please do not think that "stan-

DURING THE LIVERPOOL MEETING.



dardization" means "crystallization." It means exactly the opposite. It is an unfortunate term, but it really means co-operation for the good of industry, for the unifying of your requirements, the simplifying of your processes, and for the reduction of costs particularly in distribution, as it would be in the Gas Industry.

The PRESIDENT: I am sure we all very much appreciate the words of Mr. Le Maistre, and we thank him very much for his contribution.

Col. W. M. CARR (Stretford District Gas Board): I have been particularly interested in the first part of the paper, dealing with the organization of the Newcastle-on-Tyne industrial section, and also in the very interesting distinction given in the introduction between the domestic and industrial utilization. I am glad Mr. White has mentioned the disappointing results of an industrial furnace demonstration room, because many of us have been inclined to think that all we had to do in order to sell industrial gas was to get a room, put a few standard furnaces into it, and to invite some industrialist to see them; he would never come, of course, but we sat fondly hoping that he might. The paper emphasizes the point that the only way in which we are going to develop the sale of industrial gas is by establishing that personal service to the industrialist that will secure for us the business. On that point, apart from the many other valuable points raised, the paper gives a very useful lesson and one which we shall not forget.

ADVANTAGE OF TWO-PART TARIFF.

With regard to charges, at Stretford we have derived enormous advantage from the two-part charge, and over 80% of the industrial gas supplied there is sold on that two-part charge. But we are finding, and I think we shall continue to find, that there are numerous cases which justify special contracts. In Table III. of the paper, in which Mr. White gives various methods of charge, he includes a charge for special contracts, but I notice he limits its application to consumers taking quantities of 100,000 therms—*i.e.*, 20 million c.ft. per annum as a minimum. We have found that there are cases, and particularly cases giving continuous loads, in which it pays us to make special contracts in respect of quantities very much less than that. There are cases which cannot be met by a two-part charge. For example, there are cases where the load is confined particularly to summer time. One instance is that of a biscuit factory making ice-cream wafers, which does not work much in the winter but does a great deal in the summer. Obviously their demand charge would be too high on the two-part tariff, and, indeed, it increases the price of gas to very much above that charged to the ordinary consumer. It paid us handsomely to make a special contract in that particular case, and I would ask Mr. White if he does not agree that there are many instances for considering special contracts for less quantities than 100,000 therms per annum.

The author's reference to the correlation of information under the five headings given in Part II., in respect of which they are endeavouring, from their industrial centre, to give information to the undertakings who are co-operating, is extraordinarily interesting. The fifth facility mentioned is "To prepare and to tabulate for the confidential use of members lists of prices at which gas has been found to be competitive with other fuels." I do suggest, however, that there is a danger in giving comparative prices of fuel for a particular process unless those comparative prices are given in conjunction with a statement of conditions, of working temperatures, weight of the article dealt with, throughput, and so on. I presume, of course, that he has that point in mind, and that the paragraph simply refers to price as being the main factor. No comparison of the price of gas with that of other fuels for a particular process can be given unless the whole story is told. Too often we have suffered through our competitors giving a price per ton, say, of maximum loading, and under the most favourable conditions, which price is not that which can be remunerative under normal workshop running conditions. I should like to ask Mr. White, with regard to his comparison of the costs with producer gas and town gas for a gas-fired rolling mill, what the temperature of working was. I presume it would be in the region of 1200° C. I was also interested particularly in his figures showing the cost of generation of electricity. He considers that we ought to get down to a figure of about 22 c.ft. per B.H.P., hour. Recently I had to go into the cost of running the large units for generating electricity up to 1000 kw.-hour—a load I have not yet secured, but which I hope to secure for gas—and I was able to obtain from gas engine manufacturers a guarantee of a gas engine consumption, assuming an average loading of from 50 to 75% of 19·1 c.ft. of gas per B.H.P.-hour. Working that out, I got a figure of gas consumption per kw.-hour of 28·71 c.ft. As this was to be for continuous load, and under the two-part charge the commodity charge would be very low indeed—about 2·4d. per therm—the actual cost of generating, including interest and depreciation at 12·5% on the capital, with an addition of 2·5% for maintenance, making a total standing charge of 15%, and, including labour, oil, and gas, would be 0·47d. per unit generated. When we can get down to figures of that sort for very large consumers it seems that there is a great possibility for us to meet factory loads for the generation of electricity, particularly where these loads are continuous.

I wanted to say something about the collection of information, but I will endeavour to submit a written contribution. Meanwhile I should like to add congratulations to Mr. White and thank him very much for his extraordinarily helpful and useful paper.

Mr. F. P. TARRATT (Newcastle, the newly-elected President): I should like to express my deep appreciation to Mr. White for his kindness in preparing the paper. He has been to enormous trouble. This is one of the cases where the Institution is justified in obtaining a paper outside the Institution, and it is a paper of vital importance at the moment. Reference has been made to the unselfishness of my Company in enabling this work to be published. I do not think we ought to look at the matter in that way; we should have a broader vision. Whatever we can do for the Industry is good for ourselves as well. We here are not in competition with each other, but with outside competitors. Although Mr. White is not a member of my staff, he is a member of what I call the Newcastle team, and we are all working together to do the very best for the Industry.

It is very gratifying that the paper has been given such a good reception.

The PRESIDENT: I am sure we all thoroughly endorse all that Mr. Tarratt has said as to our indebtedness to Mr. White. I will ask Mr. White to reply briefly to some of the points raised, and perhaps he will extend his reply by means of a written communication.

THE AUTHOR'S REPLY.

Mr. WHITE: With regard to the operation of the industrial development area, we are now entering our third year of the application of this system, and there is every indication that it is more than justified. I think our subscribing members feel that we are doing our best to produce results on their behalf as well as our own. There is, however, a decided need for co-operation between areas. Whenever one attends a meeting or meets anyone connected with the subject one invariably hears of other people who are striving to perfect a certain process in which difficulties are experienced, or which has not been developed to a satisfactory conclusion; it is obviously right that there should be a degree of standardization in our methods and in our knowledge to enable us to keep together better. The tax imposed on fuel oil has given us an enormous amount of assistance. So far as one can see at the moment, we have a potential consumption, even in the few days following the imposition of the tax, of something in the neighbourhood of 100 million c.ft. per annum. This week-end we are changing over one of the largest bakeries in North-East England from fuel oil to gas, and we shall get a consumption from that source of something between 20 and 30 million c.ft. per year. That is a practical result of the tax on fuel oil.

I think the problem of smoke abatement will become increasingly important. The movement of factories to more rural surroundings will have its effect, and I believe we shall derive special benefit from that also.

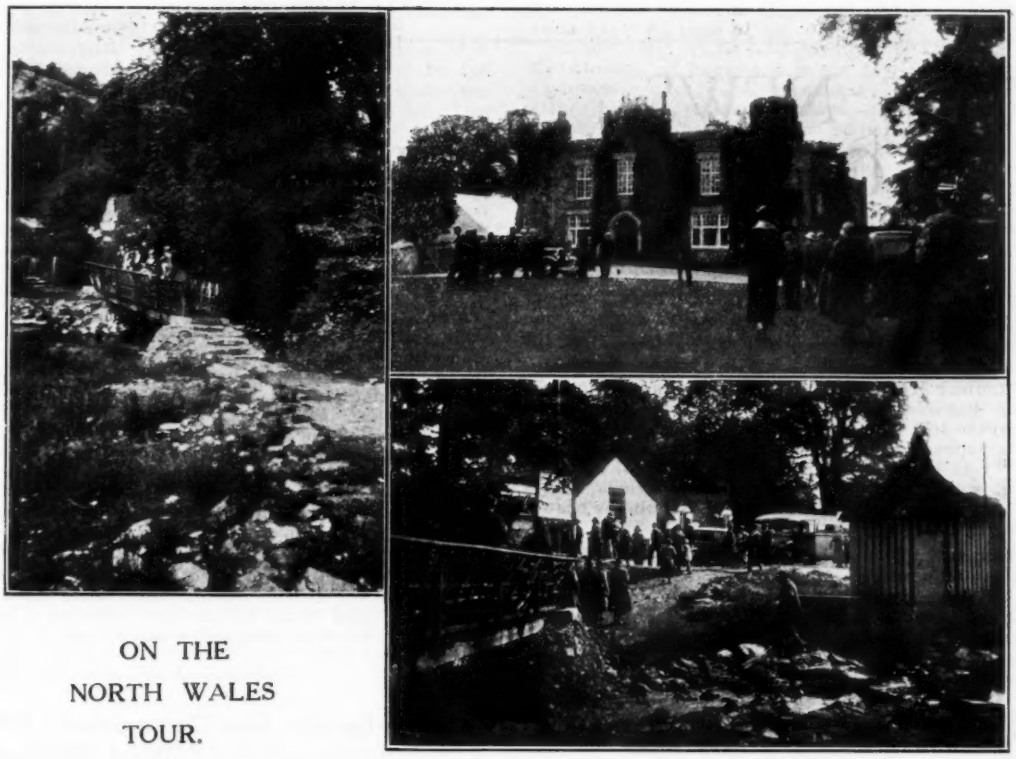
Reference has been made by Mr. Madden to co-operation with our area. It is a matter of satisfaction to us that we are working on similar lines to a common end.

With regard to the remarks of Col. Carr concerning special contracts for supplies of 20 million c.ft. per annum, there is definitely a need for special contracts relative to smaller amounts in special circumstances.

We will not willingly give any subscribing member comparative prices unless we know all the circumstances under which gas and the competing fuels are being used.

In the case of the rolling mill mentioned, the actual temperature of the slabs as drawn from the furnace is 1100° C. The temperature of the furnace is about 1225° C. As an example of efficiency I can say that the flue gas temperature is just over 100° C., as compared with the 1225° C. in the furnace.

In connection with the generation of electricity, we are working on high-speed, multi-cylinder engines. The 22 c.ft. per B.H.P.-hour given is a bench test figure, spread over almost a fortnight's continuous operation, and we believe that, given special cooling arrangements which are being developed for us—both for cooling of the lubricating oil, which is vitally important in multi-cylinder engines, and also water cooling—we can get down to a very small, compact generating unit suitable for small works with perhaps 20 or 30 kw. demand, working at a very attractive cost per unit, and that it will be a thoroughly desirable engine for operational purposes.



ON THE NORTH WALES TOUR.

Correspondence

Construction of a 3-Million Spirally-Guided Gasholder

SIR,—In your issue of May 31 Mr. Hobson is evidently not convinced of the truth of my statement in my letter of Aug. 5, 1932, as to the faulty nature of Mr. Milbourne's formula. I wish he would get some independent authority on graphical construction and mathematics pertaining thereto to go over the formula and concentrate at the point I have already named; then he might be convinced of the truth of my statement.

As to contacts over one-half of the holder, if the article I was originally referred to does not at its latter part mean this, then I do not know what it does mean. I can assure Mr. Hobson that no one has yet shown my own formula to be wrong, under the conditions I assumed; the only attempt in this regard did not apply, because it was assumed I was dealing with components only, whereas I confined myself to resultants—in my opinion, the only true method of solution. And if the proof is right for resultants it must surely be right for the component reactions derived therefrom.

As to Mr. Milbourne's supposed "test" in his own letter (which was no test at all, so I originally ignored it), he now forces me to reply on that point. I think Mr. Milbourne, as an engineer, has forgotten that the zero values which can be placed upon quantities in an expression, depend upon what the expression relates to. There are plenty of examples of this fact in engineering and other subjects, but the three following, widely differing, will suffice.

Take the well-known fraction $\frac{P-D}{P}$ relating to the efficiency of a riveted joint, where P represents the pitch and D the diameter of the rivet holes. If it is erroneously assumed that this fraction applies when any one of the quantities in it are reduced to 0, then in the event of making $P = 0$, we get the absurdity of *negative infinity*. Zero value for D, or, alternatively, for the *whole* fraction, are applicable, only, as users of the expression well know.

Take another case (and here there is but one variable): The expression for efficiency of a water jet turned back upon itself, after impinging against a surface, is $4 - 8n$ (see Prague's Hydraulics, p. 107, 1914 Edition). It is shown that the minimum value of n can only be $\frac{1}{2}$ (not 0), and attained by making the *whole* fraction equal to 0. To call $n = 0$, erroneously, would result in efficiency being 4, obviously impossible.

Again, in the *English Mechanic* of April, 1899, I indicated how impossible results occurred with the use of Geometry relating to Perspective, when a certain distance involved was indiscriminately reduced to zero (see "Geometrical Perspective" of that period).

In my present formula, which Mr. Milbourne has attacked, the minimum value of N (No. of pairs of roller-contacts) is obtained by making the *whole* of a certain fraction equal to 0, that fraction being $\frac{N-4}{8}$, because at that point or condition all the squared cosines employed vanish.

This makes the minimum value of N equal to 4, and if Mr. Milbourne asks why, I will explain further; but the answer should be obvious.

Yours, &c.,
A. GADD.

62, *Barton Arcade*,
Manchester, 3,
June 2, 1933.

PERSONAL

NEW KNIGHTS.

In the King's Birthday Honours List the honour of Knighthood has been conferred, for political and public services, on Dr. G. C. CLAYTON, C.B.E., J.P., M.P., Chairman of the Liverpool Gas Company, and Alderman E. W. WILLIS, J.P., who was appointed a Director of the Rochester, Chatham, and Gillingham Gas Company in 1906 and Chairman in 1913—a position he holds to-day.

Dr. Clayton is a Director of Imperial Chemical Industries, Ltd., and President of the Institute of Chemistry.

* * *

In the pass list for the April, 1933, Examination of the Institution of Civil Engineers the name of Mr. W. F. CATON appears as having passed Section A of the Associate Membership Examination. Mr. Caton, who is now with the Oxford and District Gas Company, was an articled pupil to Sir John Ferguson Bell, M.Inst.C.E., at the Derby Gas-Works and is the son of Mr. W. E. Caton, M.Inst.C.E., Managing Director and Chief Engineer of the Oxford and District Gas Company.

* * *

The marriage took place on June 1 of Mr. BENJAMIN THORPE, M.Inst.Gas E., Chief Chemist to the Corporation Gas Department, Huddersfield, to Miss Dorothy Miriam Townend. They were the recipients of a table cabinet of cutlery from the Gas Department staff.

THE NEWS OF THE WEEK

There Will be No Meeting of the Central Executive Board of the National Gas Council or of the Central Committee of the Federation of Gas Employers during the month of June.

The Summer Meeting of the Institution of Heating and Ventilating Engineers will be held at the Grand Hotel, Llandudno, on June 20 and 21, when a varied programme has been arranged, including a paper by Mr. I. Lubbock, M.A., on "Gas Flow and Radiation," reception, banquet, and dance, golf, tennis, and bowling competitions, and a motor drive which includes some of the most famous beauty spots in North Wales.

The Electricity Supply Failed in the Trafalgar Square area on the night of May 29 for about 40 minutes. The traffic lights suddenly went out, and police were hurriedly called out to regulate traffic. In many restaurants and public-houses where there was no alternative supply candles were brought into use. The Queen was being driven back to Buckingham Palace from the Opera during the period when the lights had failed, and her car was directed by police signals. A little before midnight the supply had been partly restored.

Gas Production Progress in Austria.—From a report recently issued by the Union of Austrian Gas-Works regarding the progress of the Gas Industry in Austria during 1932, we learn that the number of works remains the same as at the end of 1931—viz., twenty-five, of which twelve produce coal gas, nine both coal and water gas, three "double" gas, and one water gas. The total output of gas in the country during the twelve months amounted to approximately 13,153,958,000 c.ft.—an advance of 55,736,500 c.ft., or 0·43%, over the preceding year. Coal gas was responsible for 9,543,757,600 c.ft., or about 12½%, of the total. The output of coke from the gas-works amounted to 586,686 tons—an increase of 19,839 tons over 1931.

Cookery Demonstrations at Hartlepool.

In a recent week cookery demonstrations were held at the Hartlepool Gas and Water Company's new showrooms, Victoria Road, West Hartlepool, and testimony to the great interest aroused was borne by the very large attendance of ladies at each session. The demonstrations, which were ably carried out by Miss A. M. Strick, M.C.A., first-class diplomée (of Radiation Ltd.), strikingly proved the efficiency and simplicity of "Regulo" controlled gas cooking.

The feature of the week's syllabus was dinner cooked in the oven at one "Regulo" setting and time without attention. The number of entries for the cake baking competition, for which some 15 prizes were awarded by the Hartlepool Gas and Water Company, exceeded all expectations and evidenced the great appeal gas cooking makes to the housewife. The difficult task of judging the cakes sent in was carried out by Miss Strick, and Mrs. L. M. Weldon, wife of the Company's Distribution Superintendent, presented the prizes during the evening cookery demonstration, and so great was the attendance at this session that many ladies were unable to gain admittance.

Poster Display at Olympia.

It is announced that the British Poster Advertising Association, in addition to taking two of the main stands in the principal avenue at the Advertising and Marketing Exhibition, Olympia, will erect a modern style hoarding around the front of the gallery, similar to that which was such a feature of the last Exhibition. On this hoarding will be displayed various sized posters, equivalent to 94 sixteen-sheet bills, representative of the best of contemporary or recent posters on the hoardings of the members of the two Poster Associations.

These posters will be those finally selected by a special committee under the chairmanship of Mr. C. W. Gardner, the President of the British Poster Advertising Association. No charge whatever will be made for displaying the posters chosen, and all firms, users of outdoor publicity, are cordially invited to submit posters for consideration by the Selection Committee. These should be sent to: The Secretary, British Poster Advertising Association, 48, Russell Square, W.C. 1, at an early date, and *not later than June* 14.

The sizes of the posters to be exhibited are restricted to the standard 16-sheet (upright), 32 sheet, and 48 sheet—the first named being the most desirable size, owing to exigencies of space.

During the Exhibition visitors are to be asked to vote on the merits of the various posters displayed, the public vote deciding the placing of the twelve most popular posters. Valuable cash prizes amounting to £300 are being offered by the British Poster Advertising Association and the Organizers of the Exhibition, including a first prize of £100, in connection with this competition.

South-Eastern Gas Corporation's Offer for Rochester and Gillingham Stock.

The South-Eastern Gas Corporation announces that it has made an offer to the stockholders of the Rochester, Chatham, and Gillingham Gas Company to purchase the whole of that Company's consolidated ordinary stock on the following terms:

For each £100 consolidated ordinary stock either £145 in cash, or 75 redeemable 4½% cumulative preference together with 50 ordinary shares of £1 each, fully paid, of the Corporation.

The offer is open until June 15 and will become effective if acceptances are received in respect of stock to the extent of not less than 55% of the total.

Important Extensions to the B.I.F.

To meet increased demands by exhibitors, important extensions and re-arrangements of the British Industries Fair grounds and buildings at Castle Bromwich have been authorized by the Council of the Birmingham Chamber of Commerce, which is responsible for organizing the Birmingham Section of the Fair.

The Fair Management Committee of the Chamber has also decided to make an admission charge of 2s. for trade buyers attending the Birmingham Section in 1934. Hitherto buyers have been admitted to the Birmingham Section without charge, although, for the first time in the history of the Fair, buyers were charged 2s. for admission to the London Sections at the 1933 Fair.

An official announcement issued by the Committee states that provisional bookings of space by exhibitors for the Birmingham Section of the 1934 Fair are 37% greater than corresponding bookings last year for the 1933 Fair. Of a total space of 244,362 sq.ft. available indoors, 177,907 sq.ft. have been provisionaly booked already for 1934, in comparison with 129,926 sq.ft. provisionally booked at a corresponding date last year. No canvassing or circularizing of any kind has been done in respect of the 1934 Fair.

In 1920, when the Birmingham Section was inaugurated, the exhibits occupied 85,000 sq. ft. At the 1933 Fair, indoor exhibits alone occupied 244,362 sq. ft., while approximately 50,000 sq. ft. were devoted to outside exhibits.

Plans have now been approved having as an ultimate objective a permanent Exhibition Building with a total indoor area of 1,000,000 sq.ft., of which 500,000 sq.ft. will be available for exhibits. A 99 years' lease of the site has been negotiated.

Extensions are to be put in hand immediately to add 55,000 sq.ft. of indoor area, of which 30,000 sq.ft. will be let to exhibitors, in time for the 1934 Fair. This immediate addition is part of the larger plan. The additional space to be provided for the 1934 Fair will be set aside for the gas,

electricity, building, and engineering groups in which congestion has become especially marked.

In conforming with what was done at the London Sections in 1933 and making an admission charge of 2s. for buyers, the Fair Management Committee state that they have in mind primarily the interests of the trade buyer as distinct from the sightseer.

"The charge is small in comparison with that made at the Continental Trade Fairs," Mr. Greener, Chairman of the Committee, states. "In return for it the buyer will receive a badge. Without further charge this will admit him to the Birmingham and London Sections alike at any time and as often as he visits them during the entire period of the Fair.

"The charge may reduce the total number of attendances, but the Committee feel that it will not reduce the number of genuine buyers attending. On the contrary, it will help the buyers by preventing over-crowding and waste of time which is inevitable when exhibitors are occupied in attending to sight-seers as distinct from trade buyers."

Revenue derived from the sale of badges to buyers will be spent for advertising the Fair at home and abroad.

Prior to the 1933 Fair, the cost of advertising was borne by a Government subsidy of £25,000 a year. Last year, in accordance with the Government's economy measures, no grant was made for the British Industries Fair. The Department of Overseas Trade and the Birmingham Chamber of Commerce accordingly were faced with the necessity of providing expenditure for advertising from other sources.

Actual expenditure for this purpose in connection with the 1933 Fair was considerably less than in previous years. It will be increased this year, and subsequently it is hoped that further increases may be possible.

Swansea Superannuation and Co-Partnership Schemes.

The Annual General Meetings of the Superannuation Scheme and of the Co-Partnership Scheme of the Swansea Gas Light Company was held at the Y.M.C.A. (Minor Hall), St. Helen's Road, Swansea. Mr. Ernest H. Leeder (Chairman of the Company) presided, being supported by Messrs. J. F. Coonan, Hugh Bellingham, and Ernest Davies (Directors), Mr. W. H. Jones (Engineer and Manager), Mr. Ernest Ablett (Secretary and Assistant Engineer), and by members of the Committees of both schemes.

Superannuation Scheme.

In moving the adoption of the report and the accounts for the year ended Dec. 31, 1932, the Chairman said: From the statement of accounts which has been set before you and from the report of the Management Committee which sets out in clear detail the main points of the accounts, you will have already ascertained the excellent progress which the scheme has continued to make. We are indeed in the happy position of being able to say that not once since its inception in 1924 has the scheme failed to fulfil what we have expected from it. On the contrary, each successive statement of accounts has provided evidence of the sure foundations on which the scheme was started and has also given clear indications that continued success in the future can be confidently anticipated. The statement of accounts for the past year which I propose to review, show that the fund value of the scheme has reached the considerable figure of £26,443, being an increase of £2927 during the year.

Throughout the year superannuation allowances were paid to 26 members, and the total amount of such allowances was £1231, irrespective of additional grants by the Directors. The income derived from the investments of the scheme also continues to increase. During the past year such income amounted to £1359, and this amount more than covers the outgoings in respect of superannuation allowances.

Co-Partnership Scheme.

In moving the adoption of the report and the statement of accounts relative to the co-partnership scheme for the year, the Chairman said: I am pleased to be able to inform you that the Directors found it possible to allocate this year the same sum as that allocated last year—namely, £1200. This allocation—together with the balance of bonus account brought forward—has permitted a distribution of bonus at the rate of 3¼% on co-partners' salaries and wages for the year, as against a bonus at the rate of 4¾% last year and a bonus at the rate of 5% for the previous four years. You will realize that while the Directors are pleased they were able to make such an allocation, they regret that conditions did not make it possible for them to make an allocation which would have maintained the old time bonus.

Co-partners will be in a position, by virtue of the recent distribution of bonus, to make further purchases of the Company's stock, of which no less than £13,066 is now held either by co-partners themselves or by their trustees, and in regard to their holdings, co-partners will have noted with pleasure the extent to which the Company's ordinary stock has increased in value, the present quotation for this stock being approximately £98%.

I am obliged to call your serious attention to the very heavy withdrawals which have taken place during the year. These withdrawals have not only caused disappointment to the Directors, but have been the subject on more than one occasion of very serious consideration by the members of the Committee. I have mentioned this matter to you at previous meetings, but still the amount of withdrawals has continued to increase, and the Committee are of the opinion that, even taking into consideration the present hard times, there is abuse of the principles of the co-partnership scheme. Consequently, they have been reluctantly compelled to issue as a very definite warning, an intimation that the existing rules of the scheme which provide for the termination of an employee's membership of the co-partnership scheme will be put into effect unless improvement is shown. In addition to these withdrawals, there have been throughout the year instances of co-partners having sold their holdings without permission. This act is directly contrary to the rules of the scheme, and, as the result, membership of two employees as co-partners has been cancelled. I do not wish to pursue this regrettable feature any further and will content myself by saying that your Committee are decided that the scheme must function for its true object—namely, the encouragement of thrift.

Swiss Gas Association Meeting.

From a Swiss contemporary we learn that a meeting of the Union Internationale de l'Industrie du Gaz was lately held in Basle, when representatives from Belgium, France, Italy, Poland, Sweden, Switzerland, Czecho-Slovakia, Germany, and Jugo-Slavia were present.

M. de la Paulle dealt with the work of the Association des Gaziers Belges in connection with methods of developing the industrial use of gas and also by hotels, and mentioned that special attention was being given to the question of the use of gas in bakeries. M. Baril, of the Union Syndicale de l'Industrie du Gaz en France, also presented a report of the co-ordination of methods of testing gas-using apparatus, and M. Dind, of the Swiss Union of Gas and Water Engineers, one on interior gas installation work.

Dr. Muller, of the German Gas and Water Engineers Association, also stated that work had been commenced by that body on the task allotted to it with regard to the co-ordination and guarantee of the methods of testing gas producing equipment.

Mr. Frank Ayre,

Manager of the Parkinson Stove Company (Aust.), Ltd.

Human beings are always interesting to human beings, and as manufacturers are human, despite rumours to the contrary, the *Australian Manufacturer* (a weekly newspaper devoted to business and industrial efficiency and the manufacturing progress of Australasia, published in Sydney, N.S.W.) have prepared a series of character sketches, each of which deals with an Australian business man who has made his life's work the development of one or other of the Commonwealth's secondary industries.

The issue of March 25 last contained an interesting sketch of the activities of Mr. Frank Ayre, Manager of the Parkinson Stove Company (Aust.), Ltd., West Footscray, Vic. Born in Birmingham, stated the article, Mr. Ayre's education was obtained at the Waverley Secondary School and Birmingham Technical School. Subsequently he joined the Birmingham Corporation Gas Department, as junior clerk, in 1909; transferring 12 months later to the high-pressure gas laboratory which was started by that Department to develop the use of high-pressure gas in industrial heating processes; as a result of which experience, he definitely left the clerical and joined the technical staff of the Department, working on both the industrial and domestic sides. His technical studies were continued in connection with the City and Guilds of London Institute. He finally passed with honours in Gas Supply and Gas Engineering.

Then came the great "interruption," the common experience of the young men of that time, in connection with

THE NEWS—*continued.*

the outbreak of war in 1914, when young Ayre enlisted as private, in 2nd Birmingham (" Pals ") Battalion of the Royal Warwickshire Regiment. This step was followed by rapid promotion to corporal and sergeant, and in March, 1915, by his being gazetted second lieutenant in the same battalion. In June, 1915, he was appointed adjutant of his battalion; being at that time possibly the youngest adjutant in the British forces. Shortly afterwards he was first lieutenant, and was promoted captain in May, 1916. His service experience was gained in France and Belgium; and ended with eight months' captivity in Germany. Returning to England after the Armistice, he had 12 months' further service as staff captain.

At the end of 1919, on demobilization, he returned to Birmingham Gas Department, and gained further experience in technical and publicity work. At this time, he was acting as district Press representative of the two leading technical journals of the Gas Industry in England.

Another of his enthusiasms has been his interest in the education of juniors in the Gas Industry, and on the practical side he devoted a few years to teaching in trade subjects in the special evening classes which were run by the Gas Department of the City of Birmingham Corporation. In 1923 he was prominently associated with the organization of a National Gas Exhibition held in Birmingham, and which was highly successful. Immediately afterwards he resigned his position with the Birmingham Gas Department in order to join the Parkinson Stove Company, Ltd., of Birmingham, which is recognized as one of the largest and most important firms of gas stove makers in the United Kingdom, branches of this firm having been linked up with the development of the Gas Industry in general for well over a hundred years. After further experience with the Parkinson Company in office, works, and on the sales side, he was selected by his Company at the end of 1927, when it decided to open gas stove works at West Footscray, Melbourne, to take up the management of this new Australian manufacturing enterprise; a compliment the value of which can only be duly recognized by those whose experience has included a visit to this outstanding example of most modern design and organization in a factory establishment.

The Parkinson Stove Company's manufacturing establishment at Sunbury Road, West Footscray, Melbourne, which, with certain minor alterations, has been modelled upon the parent works in England, is now supplying from Australia manufacturing resources a line of household requirements with which the country has previously been familiar only as importations. With Frank Ayre, as with other personalities in the industrial works of Australia, the best reflection of character is that afforded by the establishment and manufacturing activities over which he presides. The Parkinson plant at Footscray is a model of its kind with its up-to-date manufacturing system, designed for mass production of gas cooking, heating, and hot water appliances, &c.

Driver of Gas-Driven Lorry Fined for Exceeding Speed Limit.

A motor-lorry driven by compressed gas was referred to at Kingston Police Court on June 1, when Frank Stubbs Bricknell, a driver of the Gas Light and Coke Company, was fined £1 for exceeding the speed limit (20 m.p.h.) on the Kingston by-pass.

A police-sergeant said the lorry's speed was 34 m.p.h.

Mr. F. J. Wrottesley, K.C., for the Company, said experiments were being carried out in the driving of motor vehicles by compressed gas. This lorry was one of five or six now being experimented with in various parts of England.

" The Company are keeping in close touch with the Home Office and the Ministry of Transport," Mr. Wrottesley, said, " with a view to appropriate regulations being drawn up in view of what will probably be a new type of motor vehicle. There are, of course, great advantages in having vehicles in this country driven by gas. It is home fuel, produced from British coal, as against imported fuel, and there is no smoke from the exhaust. This driver was engaged on experiments. The Company's Engineer made an adjustment a short time before which affected the amount of gas reaching the engine. That may have had something to do with the excessive speed." Mr. Wrottesley added that the experiments were of national importance, and Government Departments were interested in them. In the circumstances he asked the Bench to deal with the case as leniently as possible.

Mr. F. Hawkey, Chairman, said the magistrates were of opinion that the Company were, in a sense, guilty of presuming that they could go outside the law to try experiments on the public road.

Hull and District "K.C.U. Week"

A co-operative " K.C.U. Week " was recently made in Hull and District by the British Gas Light Company, Ltd., the East Hull Gas Company, the Hessle Gas Company, the Hornsea Gas Company, and the Beverley Gas Company. The scheme was successful in bringing the " K.C.U." water heater to the notice of gas consumers in the area served by these Companies. The whole of the windows of the various showrooms were given up to most attractive window displays, and the windows were dressed in a colour scheme of blue and white. An arresting 10-in. triple column co-operative advertisement appeared in the " Hull Daily Mail " and other newspapers during the " K.C.U. Week," and we understand that a considerable amount of local interest was created, resulting in a large number of consumers visiting the various gas showrooms. We reproduce a photograph showing five of the several important windows of the main showrooms of the British Gas Light Company, Hull, which it will be seen were laid out in a most effective style.

A TECHNICAL SIGNPOST : TO THE "JOURNAL" :

Vol. 201, *January-March*, 1933

General.

The figures in the Fourth Census of Production (1930) relating to Gas Undertakings have now been published (p. 94), and by comparison with those of the previous Census (1924) form a useful guide to the progress of the Gas Industry. The returns, which include only those Undertakings employing ten men or over, show an increase in gas production of over 20% in the six years. Figures are not available, for direct comparison, of gas sold and prices obtained, but the price is generally appreciably lower in 1930. In regard to bye-products, large decreases in gross revenue are to be noted, despite the increased production. For example, the price of coke fell from 30·44s. to 23·01s. per ton in the six years under review, while the reductions in tar and ammonia prices are even greater.

The annual reports of most Gas Companies have now been published, and in the case of those of the Metropolitan area, reductions in gas sales of 2½% to 4% are recorded, which are attributed to depressed trade conditions and abnormally mild weather. While in all cases there is a loss on ammonia products, the revenue from tar products shows a slight improvement. Of special interest is the inclusion of the Gas Light and Coke Company in the newly formed South-Eastern Gas Corporation which is acquiring undertakings in the South-Eastern area (p. 380). In the report of the South Metropolitan Gas Company, further details are given of this Company's "Coalite" low-temperature carbonization plant (p. 382). This plant has worked throughout the year, and a number of troubles have apparently been encountered which it is hoped will be ultimately overcome. It is stated, however, that up to the present the plant has not been a paying proposition.

The danger of poisoning by carbon monoxide is not the least of the objections frequently advanced against the use of coal gas, and some investigations on this subject, which have recently been published (p. 261), are of considerable importance. It is generally appreciated that the so-called "poisoning" is virtually the replacement of the oxygen by carbon monoxide in the hæmoglobin of the blood and consequent asphyxia. The absorbed carbon monoxide is dispersed by the further inhalation of oxygen, but unlike oxygen is not consumed by the tissues. What is, however, of special importance is the relative rate of absorption of oxygen and carbon monoxide by the hæmoglobin. This is found to be dependent upon the relative concentration of these gases in the air, but the absorption of carbon monoxide *per se* is much greater than that of oxygen. For example, in an air containing 20% oxygen and 1/300% carbon monoxide, the gases are absorbed in equal proportions by the blood. The absorption of carbon monoxide continues until an equilibrium condition is reached, when the ratio of oxygen to carbon monoxide remains constant, and no further carbon monoxide is absorbed. Experiments were made to determine the time required for the attainment of 50% of this equilibrium value with air containing various proportions of carbon monoxide. Thus, in air containing 2 parts of carbon monoxide per 10,000 parts, which has an equilibrium value of 23% carbon monoxide, a value of 11-12% was obtained after one hour. With 8 parts of carbon monoxide per 10,000, the equilibrium value is 53%, and 26-34% was recorded after one hour. At this latter and at higher concentrations, distinct ill effects were felt by the patient. If active exercise is being taken, the absorption of carbon monoxide is accelerated in proportion to the more rapid inhalation.

Another investigation (p. 262) has been concerned with the question of the so-called immunity of habitual workers in atmospheres containing carbon monoxide. Experiments show that after the initial absorption of the gas, subsequent absorptions are smaller and the pathological effects are less pronounced. While no definite explanation is yet available, it has been suggested that there may be an automatic increase in the number of red blood corpuscles when in contact with carbon monoxide.

It is well known that in several plants on the Continent, coke oven gas is used as a source of hydrogen for the manufacture of synthetic ammonia, but little is known of the subsequent utilization of the residual gas. In a recent paper (p. 202) before the Institute of Fuel, some details are given regarding the use of coke oven gas on the Continent for the manufacture of organic chemicals. By fractional liquefaction it is possible to produce various gaseous mixtures—*i.e.*, gases rich in hydrogen, methane, or carbon monoxide, which may be used for the production of synthetic ammonia, methyl alcohol (methanol), and other organic compounds. Various methods have been adopted for the manufacture of these compounds. Where ammonia alone is required (Gesellschaft für Köhlentechnik), the methane is converted into carbon monoxide and ultimately into carbon dioxide by passing the gas together with water vapour over a catalyst, the carbon dioxide being absorbed by water leaving a hydrogen and nitrogen mixture. If methanol alone is required, a mixture of carbon monoxide and hydrogen is produced (Société Courrières Kuhlmann), or the manufacture of the above two products may be combined. This is the practice of the Société d'Ougrée Marihaye, who originally used a liquefaction gas, rich in methane, but more recently have employed purified coke oven gas. This is oxidized by a mixture of air and oxygen, and yields a gas containing under 1% methane, while the carbon monoxide content is reduced to that required for methanol synthesis (*i.e.*, about 12%) by oxidation of the excess to carbon dioxide. Similarly, complete oxidation of the carbon monoxide gives a gas containing only hydrogen and nitrogen and which is directly utilizable for ammonia synthesis.

By heating methane at temperatures of 1200°-1500° C. and subsequently rapidly cooling the gases a large yield of acetylene can be obtained. The Société Franco-Belge d'Ougrée has developed a process on these lines, a gas rich in methane being preheated to 800° C. in the presence of water vapour (to avoid preliminary decomposition) and then heated rapidly to 1600° C., when 30-40% of the methane is converted into acetylene.

A number of attempts have been made to extract ethylene from coal gas, and the Compagnie de Béthune now claim to have established a practical and economic process. Compressed coke oven gas is washed with concentrated sulphuric acid in a series of towers, and the resulting ethyl hydrogen sulphate is saponified with water and distilled, the acid being recovered from the condensate and used for sulphate of ammonia manufacture. It is stated that an absorption efficiency of 95% has been obtained. The crude alcohol produced is a mixture of alcohols from which absolute alcohol can be obtained by rectification, and in conjunction with the latter process, a method has been worked out for the conversion of isopropyl alcohol into acetone. The possibilities of using coal gas as a basis for the manufacture of organic intermediate compounds is almost unlimited and deserves most careful examination by the Gas Industry.

Carbonization.

For some years past claims have been made regarding the advantages to be derived from the mixing and blending of coals, both in regard to the throughput of the retorts or ovens and also in regard to the yields and characteristics of the resulting products. The position, as it exists at the moment, has been summarized in a recent paper by Hollings (p. 370), who describes two new installations of the Gas Light and Coke Company specially designed for the large-scale investigation of this subject. The necessity for a clearer distinction between "mixing" and "blending" is emphasized, and it is proposed that the term "blending" be confined to mixtures, the components of which do not exceed ⅜ in. in size. It is now well known that appreciably greater throughputs can be secured in continuous vertical retorts by screening out the smaller sizes, and tests are quoted which tend to indicate that the throughput of such retorts may be influenced to a considerably greater extent by the size of the coal than by any blending or mixing process. Since blending involves reduction in the size of the coal, it follows that true blending is not necessarily conducive to an increased rate of carbonization in continuous vertical retorts.

The difficulty may be overcome by the prior briquetting of the blend, but results then obtained indicate that the improvement is probably due more to the open texture of the charge resulting from the use of briquettes than to the actual blending of the coals. Several advantages are, however, claimed for the use of blended coals when carbonized in intermittent processes—viz., increased rate of

carbonization (particularly when coke breeze is blended with the coal), improved coke structure, &c. There is, however, a serious drawback to the use of crushed coal, in that the ash produced on combustion of the coke is present in such a fine form as to prejudice the popularity of the fuel for domestic purposes. In the coke oven industry this difficulty does not present itself, and considerable improvement in the coke has been obtained by fine grinding and blending of coals of different coking properties.

Both high and low temperature coke have been used for blending in order to reduce the swelling and coking powers of strongly coking coals, but it should be noted that "it is very doubtful whether coke breeze can be profitably mixed with coal in this way without crushing the blend below about ¼ in. size." The peculiar advantage to be gained by the use of low-temperature coke lies in the fact that a smaller proportion is required as compared with a non-coking coal.

The two outstanding problems requiring attention are therefore (1) the value of blending in relation to throughput in continuous and intermittent carbonizing units, and (2) the influence of blending on the quality of the coke produced—according to whether coke for domestic or industrial purposes is required. Experience has shown that these questions can only be answered by trials on full-scale plant, and in the installation recently erected at Beckton the plant is so arranged that Durham coal may be screened, the oversize (over 1 in.) being used for vertical retorts, while the undersize (about 80% of the coal) may be either used directly in horizontal retorts or crushed to under ⅛ in. size for blending. The mixing bunkers are equipped with rotary feed tables so that two or three coals may be blended together.

At the Southall Works, a more comprehensive scheme has been designed. Three sizes of coal are first produced—viz., over 2½ in. for vertical retorts, 2½-¾ in. for intermittent chamber ovens, and under ¾ in. for blending purposes. Non-coking coal is carbonized by the Salermo process, and the resulting hot low-temperature coke is conveyed to a coal mixer (40 tons per hour), where it is blended with crushed coking coal, the sensible heat of the coke evaporating some of the moisture in the coal. Alternatively, high-temperature breeze may be substituted for the low-temperature product. After mixing, the material is passed through a Carr's disintegrator where it is reduced to under ⅛ in. mesh. If desired, the blend may be briquetted, and for this purpose pitch is introduced before disintegration. When briquetting is not required, the blend is carbonized in intermittent vertical chambers. Thus, Durham coal of various sizes can be blended with high or low temperature coke or non-coking coal, and, in addition, the blend may be briquetted. The results obtained from these installations will, when published, be of the greatest value to the coal carbonizing industries.

The erection of several new carbonizing plants are reported. Installations of sixteen 50-in. Glover-West retorts have been completed at Stirling (p. 746), and of Woodall-Duckham 62-in. retorts at Clacton-on-Sea (p. 806). A new intermittent vertical chamber oven has now been developed by the Glover-West Company (p. 803), an experimental unit of which has been installed for the Gas Light and Coke Company, and, in addition, two installations of these ovens are in course of erection on the Continent. The main feature of the plant would appear to be that the coke is cooled in the base of the chamber, being discharged dry and cold. A unit of C.O.L. ovens is being erected at Vancouver, B.C. (p. 739), and consists of twenty-four chambers with a total output of 3 million c.ft. of gas per day, the heating gas being supplied by outside producers. The Didier Company in Germany has introduced a modified type of chamber oven which is virtually a combined water gas generator and retort (p. 466). The oven is divided into two chambers by a vertical partition which extends to within a short distance of the top of the oven. The smaller of the chambers is filled with coke, and when this has reached the oven temperature the other section is charged with coal. The coke charge is steamed throughout the carbonizing period, and the coal charge during the last two hours of the period, the coal and blue water gas being subjected to some cracking in the hot free space above the charge. A yield of 99·4 therms per ton was obtained, the calorific value of the gas being 465 B.Th.U./c.ft. and the fuel consumption 16·55%. The consumption of steam was 14·3%, of which 88% was utilized in the coke chamber and 12% in the coke charge. The economy of supplying the heat required for the water gas reaction through the walls of the coke chamber would appear doubtful, although the fuel consumption claimed is not abnormally high.

A paper which has been given (p. 316) describing carbonizing practice in 103-in. Woodall-Duckham retorts at Wallasey contains several points of interest. The settings are heated by producer gas from external step-grate producers in which a large percentage of breeze—viz., 80%—is gasified. Results are given which indicate that the fuel consumption of the settings—about 13%—remains practically unchanged whether 40% or 80% of breeze is used, but it should be noted that the breeze includes all material up to 1⅛-in. mesh. The retorts are comparatively new, being only lit up in July, 1932, and over the subsequent six months a yield of 83 therms per ton was obtained, the coke for sale being 10·2 cwt. per ton. A large proportion of coal from North Wales is carbonized, and it is noted that the average ash content of all the coals carbonized has not exceeded 4% over a period of twelve months, while the North Wales coal has averaged the low figure of 2%.

Further experiments have now been carried out at the Fuel Research Station on the throughput of horizontal retorts, and details of these are given in the recent Annual Report (p. 735). With a Durham coal, the throughput was increased from 10 to 17 tons per day by the re-circulation of hot waste gases through the setting at the expense of a reduction in gas yield of 2·5 therms per ton of coal and an increase in fuel consumption from 3·38 to 4·37 cwt. per ton of coal (including coke equivalent of power for driving circulating fan). The increased rate of carbonizing is accounted for by the higher average retort temperatures due to more uniform heat distribution, the temperature of the bottom retorts being increased by about 100° C., while the temperature distribution along the length of the retort is considerably improved.

Refractory Materials.

From a recent paper (p. 146) to the Australian Gas Institute it would appear that very serious difficulty has been experienced at Melbourne from the spalling of silica in continuous vertical retorts. On changing over from fireclay to silica the formation of scurf was considerably accelerated, and ultimately necessitated lower working temperatures, thereby losing one of the principal advantages of the silica material. At every scurfing operation spalling took place, although this was confined to a zone about 6 in. above the point of combustion to about 4 ft. down the retort, coinciding with the zone of maximum temperature. The author of the paper had apparently come to the conclusion that spalling troubles of equal severity were quite general, a conclusion which is not, however, generally accepted. Since the difficulty is confined to a relatively small zone, it has been frequently suggested that some other material might here be substituted for silica, although the high cost of a suitable material is a serious deterrent.

In a letter to the "Journal" (p. 459), C. R. F. Threlfall suggests that spalling may be attributed to excessive porosity—viz., 25-30%—and that if this be reduced to say 22%, the trouble would be considerably alleviated. While advocating the use of special material for local zones, he points out that the cost of refractories is a relatively small proportion of the total cost—namely, 3-4%. The expansion of silica is regarded as an even more serious problem, and it is suggested that a firebrick (containing over 40% alumina) can be obtained, which will stand temperatures up to 1450° C. and is only slightly less refractory than the silica product. By using such a material most of the disadvantages at present incurred by the use of silica may be avoided. If such materials are available, and if their characteristics can be consistently reproduced, they undoubtedly deserve examination on a large scale.

A recent patent (B.P. 382,425) by West's Gas Improvement Company, Ltd., relates to methods of spraying vertical retorts. Air and patching fluid pass through separate cooled conduits to the section which requires attention. Cold air is used to prevent an excessive rise in the temperature of the retort and the too rapid drying of the patching material.

Purification, Benzole Recovery, &c.

Several American investigators have been attempting to increase the activity of oxide purifying materials by the addition of active carbon (p. 357). As would be anticipated, the rate of absorption of hydrogen sulphide is considerably improved, the influence of the carbon being more pronounced the smaller the size of the particles used. Considerable quantities of carbon (over 20%) are added, but as it normally would not be recoverable from the spent oxide, the economics of the process do not appear very attractive.

A lengthy and comprehensive paper (p. 750) has been given by Wearing on the theoretical aspects of benzole recovery. Three methods are discussed—(1) by compression and refrigeration, (2) by absorption by solids, and (3) by absorption by liquids—but only the two latter are discussed in detail. The information given regarding absorption by solids is of special interest, as this method has been very little used in this country, whereas the principles and practice of the oil washing method are widely known. The absorption by solids, such as silica-gel and active car-

bon, may be due to both condensation of the gas in the pores of the absorbent or to the attraction of molecules of the gas or vapour to the surface of the material. The adsorptive capacity is naturally dependent upon the type of adsorption which is involved, and where capillary condensation predominates, the adsorptive capacity is independent of the composition of the vapour, whereas it is influenced by the composition of both vapour and material where surface adsorption is involved. The adsorption by silica-gel is largely of the capillary type, whereas with active carbon both types of adsorption exist in proportions varying according to the origin and method of preparation of the carbon. Adsorption continues until equilibrium is reached between the hydrocarbons in the vapour phase and in the adsorbed phase, when no further adsorption takes place. Heat is evolved on adsorption, due to the latent heat of condensation, &c., but the effect of temperature is less pronounced than in the oil washing method. Thus, in the latter, the reduction in benzole recovered per degree Centigrade rise in temperature is about 3% as compared with 1% for active carbon.

Water vapour does not appreciably influence the adsorption of benzole by carbon, but water in the pores of the carbon reduces the percentage of benzole adsorbed before the equilibrium value is reached. The removal of the benzole from the active carbon is generally carried out by open steaming, but closed steam coils are embedded in the carbon to reduce the condensation, and, after stripping, the carbon does not contain more than 10% of water. The decrease in adsorptive capacity which takes place has been attributed to the polymerization of unsaturated hydrocarbons to resins which tend to fill up the pores of the carbon. By passing the coal gas and steam in opposite directions, however, the penetration of the high-boiling unsaturated compounds is minimized and the life of the material correspondingly extended.

Coke.

To overcome the difficulty of igniting high-temperature coke, it has been suggested by Hodsman (p. 737) that the coke might be coated with a film of coal dust. Experiments have been made using hot road tar as an adhesive and spraying the coke with finely powdered coal dust. The volatile matter is thus increased to 4%, rendering the coke easily ignitible, although it is temporarily rendered smoky, and a smokeless adhesive would obviously be preferable. No mention is made of the possible economics of such a process, but at first sight these do not appear promising.

A simple device is described in the Annual Report of the Fuel Research Board to enable coke to be burnt in an ordinary open grate (p. 740). In order that the majority of the draught may be concentrated on the fuel bed, a sheet of polished aluminium extends from the canopy to the fuel bed, the lower end being about 2 in. from the grate back. An incidental advantage is the prevention of down-draught for which purpose several of the grates have been fitted in Government offices. In the same Report is given further information regarding the gasification of high-temperature breeze in an outside producer, and details are included of the operating routine.

Tar.

Some revival of interest in low-temperature tar products has taken place subsequent to the announcement (p. 360) that the Admiralty had placed a small contract with Low Temperature Carbonisation, Ltd. ("Coalite"), for the supply of a prepared low-temperature tar for fuel purposes. Some tests have already been made on this oil, and the contracted supply is presumably to be used for further experiments. In addition, the Air Ministry have contracted with the same Company for a supply—for experimental purposes—of aviation spirit prepared from the products of low-temperature carbonization.

Some interesting information has been given concerning the difficulties encountered in the use of creosote for motor transport at Salford (p. 369). Commencing with an apparently ordinary creosote oil, difficulties were experienced from excessive oil dilution and carbon formation. Eventually, more suitable oil was obtained from which naphthalene did not crystallize out—a source of difficulty with earlier supplies—and with this oil the above difficulties were considerably reduced. Although the standard induction pipe was used, it was necessary to change over to petrol for starting and idling. Further, creosote was found to be less responsive than petrol, and some care was necessary when suddenly accelerating.

The work of the Fuel Research Board on the cracking and hydrogenation of tars, &c., is summarized in a recent Annual Report (p. 735). The practicability of hydrogenating low-temperature tar is confirmed, a typical experiment giving a yield of 11·6 gallons of motor spirit and 8·6 gallons of Diesel oil per 20 gallons of tar hydrogenated (1 ton of coal), the consumption of hydrogen being 2400 c.ft. Experiments with high-temperature tar fractions—*i.e.*, creosote and anthracene—gave results comparable with the above, but the direct treatment of crude high-temperature tar does not appear economical. In regard to the life of the ammonium molybdate catalyst, little deterioration is found when the hydrogenation takes place in the liquid phase, but there is a rapid decrease in efficiency in the vapour phase. Various claims have been made from time to time regarding the suitability of low-temperature oils as lubricants. Up to the present none of the hydrogenation products have behaved satisfactorily as lubricating oils; but oils obtained by the polymerization of the unsaturated constituents of light oils have yielded a lubricating oil equivalent to a good commercial product. Further experiments are being carried out on this aspect, and there appears to be some promise of a suitable oil being produced.

Ammonia.

The recent Annual Report (p. 53) of the Sulphate of Ammonia Federation, whose members are responsible for the production of over 92% of the sulphate of ammonia manufactured in the British Isles, makes somewhat dismal reading. The market still remains open to violent fluctuations in price, and no agreement, either international or European, for restriction of output and control of prices has yet been possible, despite the fact that the quantity of sulphate of ammonia which the world is now capable of producing is 140% in excess of the present consumption and 100% above the maximum recorded consumption. Although the lower price has not greatly stimulated sales, preference is naturally being given to the lowest priced fertilizer with the result that, in this country, the consumption of sulphate of ammonia has increased by about 10½%, and, for the first time since 1926, consumption has overtaken production.

It is interesting to note the steps which are being taken at Stockholm to deal with the ammonia problem (p. 95). Owing to a large increase in output, it has been possible to reduce the cost of manufacture to a figure similar to that obtaining in 1913; but, in spite of this, the process was uneconomical, and since 1931 only the free ammonia has been recovered from the liquor. This further economy, together with a decrease in the cost of sulphuric acid, has reduced the manufacturing costs sufficiently to allow of profitable manufacture. The production of alternative ammonium products is also discussed, and mention is made of the successful use of crude liquor as a fertilizer.

Storage.

The findings of the Governmental Inquiry into the explosion of the waterless gasholder at Neunkirchen have recently been published. It is now established that an initial explosion took place in a rider main adjacent to the holder, with the result that the inlet main to the holder was fractured and the gas caught fire, the flames playing on the side of the holder. While the exact *modus operandi* of subsequent developments can only be surmised, it may be inferred from the force of the final explosion that a considerable volume of air-gas mixture had been formed and subsequently exploded. While this combination of circumstances may never occur again, the provision of means of effectively ventilating the space above the piston of waterless holders should be carefully considered.

The danger to the structure of gasholders arising from heavy deposits of snow was demonstrated during the heavy snowfall in March (p. 610); at the Low Moor Works of the Bradford Corporation a mass of snow sliding off the crown of a 170,000 c.ft. holder fractured one of the standards and resulted in a loss of 140,000 c.ft. of gas, while at Drighlington a holder was caused to tilt by an unevenly distributed mass of snow, and a similar volume of gas was lost.

A small unit (70,000 c.ft.) of a somewhat novel design of waterless holder has been erected in Berlin by the Bamag Meguin Company (p. 312). The piston is sealed by a circular tube of leather, suitably supported against the outer shell, and through which oil is circulated under pressure. Some of the oil percolates through the leather and thus forms a lubricant between the holder shell and the leather sealing tube. A second (lower) tube is also provided in case of escape of gas past the upper sealing ring.

Research on Coal and Coke

Report of the Northern Coke Research Committee for 1932

During the latter half of 1932, changes in organization were necessitated by the resignations of the Hon. Secretary and Director of Research, Prof. H. V. A. Briscoe, A.R.C.S., D.Sc., F.I.C., on his appointment to the Chair of Inorganic Chemistry at the Imperial College of Science, London, and of the late Dr. C. B. Marson, M.Sc., F.I.C., the Senior Chemist, on his appointment to the Headship of the Chemistry Department of Hull Municipal Technical College. The vacancies thus caused have been filled by the appointment of Prof. H. L. Riley, A.R.C.S., D.Sc., D.I.C., Professor of Inorganic and Physical Chemistry at Armstrong College, as Hon. Secretary and Director of Research, and of H. E. Blayden, B.Sc., A.I.C., Assistant Chemist to the Committee, as Senior Chemist. The Committee has been fortunate in retaining Prof. Briscoe's valuable advisory services in his capacity as one of its members.

The Committee, conjointly with other industrial and research organizations, has assisted in the examination and formulation of standard methods for the sampling and analysis of coal and coke. It was possible, largely as a result of investigations outlined in this and previous reports, to arrive at a basis for the preparation of standard methods for the determination of agglutinating index and the phosphorus content of coal.

Agglutinating Test for Coal.

Previous work on the Gray-Campredon test has shown that consistent results were more readily obtained by the use of suitable silica crucibles and an electric muffle furnace, in place of the customary platinum crucible and Mèker burner; and that the personal error in the test was so great as to require rigid standardization of the manipulative details. The effect of experimental variables has been studied, and it has been shown that four out of seven methods in use for mixing the coal and sand were unsatisfactory, in that they gave non-uniform mixtures. Satisfactory mixing was secured by the use of sand graded between 40 and 50 I.M.M. mesh sieves, coal passing a 90 I.M.M. mesh sieve, and a strictly defined method of mixing before and after placing the mixture in the silica crucible. Maximum homogeneity of the sand and coal mixture was obtained by incorporation of a small amount of glycerine with the sand, immediately before mixing. This method, however, gave unexpectedly high values of the agglutinating index, although glycerine by itself did not agglutinate the sand particles. An increased range of 0-80 units of the agglutinating index was obtained by the use of glycerine, but much further work was necessary to corroborate these results. Storage of finely crushed Durham gas coal and Durham coking coal decreased their agglutinating indices. It was further shown that—

(1) The agglutinating index obtained was markedly affected by the nature of the sand employed. Sand obtained by sieving the ignited residues of previous tests gave results widely different from those obtained when using clean, fresh sand.
(2) The strength of the coked mixture was influenced by the time elapsing between carbonization and removal of the mixture from the crucible before testing.
(3) Preliminary compression of the sand and coal mixture had no appreciable effect upon the amount of residue obtained, but indications were obtained that the strength of the coked button was affected.

Variation of the determined agglutinating index of several coals was obtained even under rigorously controlled conditions.

As a result of the Committee's examination of the agglutinating test it was possible to recommend several advantageous modifications of the test, which were recently incorporated by the British Standards Institution in their proposed standard method.

It has again to be emphasized that the investigations reported were concerned only with the effects of experimental variables in the test and that the ultimate value of the test as a means of assessing the coking properties of coals requires further demonstration.

Evaluation of Coking Coals and Coal Mixtures.

During the past year an apparatus was devised to measure the changes in volume of coal, and the characteristic temperatures at which these changes occurred when it was carbonized in thin layers by heating slowly and uniformly from one side of the layer only. A number of coals and coal blends giving cokes of known properties in a full-scale or experimental oven, were examined in this apparatus. With coal blends, it was found that the observed percentage contraction and expansion was not proportional to the composition of the blend, and that there was a tendency for the temperature at which swelling ceased, to reach a maximum with blends containing 80% of the superior coking coal. The same coals and coal blends were also examined in the Committee's special apparatus for the determination of the volatile matter content of coal at different temperatures during its slow and uniform carbonization. Combination of the results of the two tests indicated a tendency for low volatile matter content of the coal, at critical temperatures during carbonization (*e.g.*, at the temperature and cessation of swelling), to be associated with high shatter index of the corresponding coke prepared in the experimental oven. It is interesting to note that similar indications were also obtained by the Scottish Coke Research Committee. The experiments are being extended to the examination of coals which yield cokes of known properties on carbonization in a full-scale oven. It is hoped that this investigation will also be of use in devising a test for detecting coals liable to " hang " in vertical retorts or to give difficulty in " pushing " after carbonization in the oven.

Experimental Errors of Routine Tests.

In collaboration with the Northumberland and Durham Coal Survey Committee, the errors of routine tests upon coal were examined on the basis of the probability of the error-magnitudes in the results of a large number of determinations of the same kind, made upon the same sample of coal. The following tests were examined: The determination of moisture, ash, volatile matter, hydrogen, carbon, sulphur, nitrogen, and oxygen contents, and calorific value. It was found that, while the experimental errors agree in some cases (*e.g.*, the determination of moisture, ash, and volatile matter) with the commonly accepted values, they are unexpectedly high in other cases (*e.g.*, the determination of carbon).

A detailed report of this investigation will be published, jointly with the Northumberland and Durham Coal Survey Committee, in the near future.

Researches on Coke.

The Committee has assisted the British Standards Institution in the preparation of the following standard methods for the examination of coke: Sampling, determination of the shatter index, bulk density, true specific gravity, moisture, volatile matter, ash, sulphur, phosphorus, and calorific value.

The experimental errors of routine determinations on coke were examined, in collaboration with the Northumberland and Durham Coal Survey Committee, by methods similar to those used in the case of determinations on coal and of the shatter index. The following determinations were examined: Determination of ash, moisture, volatile matter, carbon, hydrogen and sulphur contents, true specific gravity, apparent specific gravity, and porosity. It was found that the experimental errors of the determination of moisture, volatile matter, hydrogen, and sulphur contents were the same as those for corresponding determinations upon coal, and were in agreement with the generally accepted values. The errors of the determination of the ash and carbon contents were slightly greater with coke than with coal. The experimental error of the determination of true specific gravity was increased six times by deviations arising from sampling. The determination of apparent specific gravity, true porosity, and apparent porosity by existing methods was found to be affected by unduly large errors.

More trustworthy methods of determining apparent specific gravity are being examined.

Determination of Phosphorus in Coke.

Previous work on the determination of phosporus in coke by the Committee shows that, out of nine methods representative of those in general use for the determination of phosphorus, only two give consistently accurate results. Of these two superior methods, that recommended by the Committee, as meriting consideration as a standard method, involves a twice-repeated extraction of the ash with mixed nitric and hydrofluoric acids, subsequent evaporation, solution of the residue in dilute nitric acid, and precipitation of the phosphorus as ammonium phosphomolybdate. The phosphorus is then determined volumetrically by solution of the precipitate in standard sodium hydroxide solution and titration of the excess of sodium hydroxide by standard nitric acid.

The conversion factor to be employed in the volumetric

determination of the phosphorus by this method was determined under rigidly controlled conditions by analysis of pure sodium phosphate solutions and found to be

1 c.c. N/10 NaOH ≡ 0·000134 gramme of phosphorus.

When, however, the ammonium molybdate solution employed was heated to 65° C., allowed to stand for about 18 hours and filtered before use, the appropriate factor was

1 c.c. N/10 NaOH ≡ 0·000135 gramme of phosphorus,

a figure which agreed with that deduced on theoretical grounds.

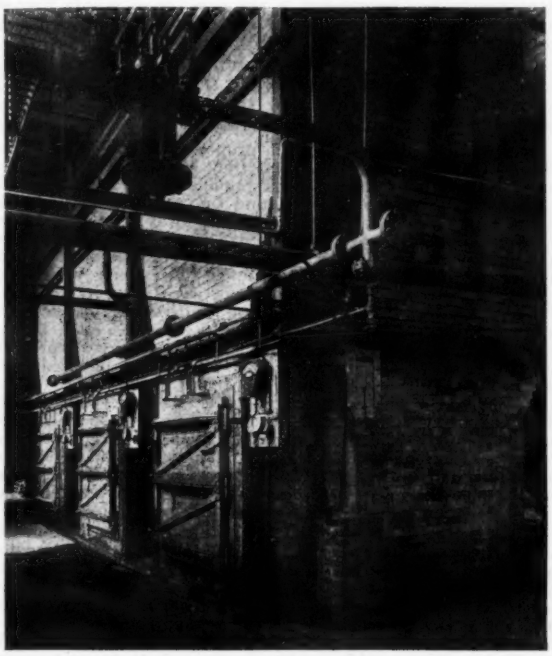
The recommended method was also examined with reference to the possible interference of titanium. It was found that controlled addition of titanium dioxide to coke ash, in amounts up to 3% TiO_2, had only a slight effect upon the result of the determination. It was concluded that the interfering effects of titanium present in amounts up to 3% were insufficient to warrant the elaborate procedure necessary for its elimination, particularly in view of the possibility of the simultaneous removal of phosphorus.

The experimental error of the determination of phosphorus by the recommended method was determined by application of the theory of errors to a large number of determinations made on the same coke ash. It was found that, in the case of the two coke ashes examined (containing 0·556% and 0·297% phosphorus), the accuracy of the mean (A) of duplicate experiments was such that the "true" phosphorus content lay within the limits given by A ± 1·6% of A, with a probability of 10/11, or odds of 10 to 1.

The difference between the means of duplicate determinations was shown to be significant, with a probability of 10/11, or odds of 10 to 1 of the difference being real, if this difference exceeded 2·3% of the phosphorus being determined.

Research During 1933.

Subject to sufficient funds being available the Committee proposes to concentrate during 1933 upon problems related to the metallurgical applications of coke. The behaviour of coke in the domestic stove or fire will also be investigated in collaboration with the Scottish Coke Research Committee.



Breeze-Burning Producers at Kilmarnock.

NEW PLANT AT KILMARNOCK

Formal Inauguration of Installation of Glover-West Verticals

An extensive addition has recently been made to the carbonizing plant of the Kilmarnock Corporation Gas-Works at Riverbank. This consists of an installation of Glover-West vertical retorts erected by Messrs. West's Gas Improvement Company, Ltd., of Manchester. The new plant was formally inaugurated on Wednesday, May 24, when an inspection was made by members of the Town Council and burgh officials under the guidance of Mr. R. B. Glover and Mr. C. A. Poulson, representatives of the contracting firm, and Mr. Charles Fairweather, the Gas Engineer and Manager.

The history of gas in Kilmarnock dates back to the year 1822, when the first meeting was held of the original "Kilmarnock Gas Company," and in the following year the works were completed and a gas supply given to the town. The gas undertaking was administered by the private company until 1872, when it was transferred to the Corporation of Kilmarnock.

The output of gas in 1872 had reached the figure of 50 million c.ft. per annum; under the control of the Corporation this figure has increased so considerably that in the current year the gas manufactured will amount to 364 million c.ft. Gas has become so much an essential to the community, that despite the fact that electricity has been at the service of Kilmarnock since 1904, the sale of gas this year will exceed all previous records, and will be double what it was 25 years ago.

The Carbonizing Plant.

The installation of Glover-West vertical retorts, placed in what originally was the horizontal retort house, comprises twenty-four 50-in. new model retorts, 25 ft. long, built in silica material, with the enlarged fireclay steaming chamber at their base. The twenty-four retorts are capable of producing approximately 2½ million c.ft. per day. They are arranged in units of four, and are supplied by fuel gas from a battery of three breeze-burning producers, two of which are capable of supplying the full requirements of the retorts, which are served from a common producer gas flue.

These producers are of the latest breeze-burning step-grate type, fitted with wrought-iron doors and steam-air blowers. A set of gauges to each producer indicates at a glance the pressure of the steam, the temperature of the steam-air mixture, the pressures of the mixture under the bench and in the uptake flue. Apart from the fact that these producers allow an increased sale of larger coke, the simplicity of design and easy method of regulation is a feature of their construction. Full advantage has been taken of the previously existing plant in the layout of the new scheme. The coal is received by the West lip-bucket conveyor from a shortened section of the original push-plate conveyor, and transported to the overhead storage bunkers of 48 hours' capacity. The lip-bucket conveyor is equipped with an automatic oiler which can be put into operation at will for the daily lubrication of the wearing parts. Coke to producers can also be handled by this conveyor into a storage hopper, and an existing hoist has been re-erected within the new retort house to facilitate access to the various parts of the plant.

The intermittent vertical retort plant, which was in operation prior to the installation of the continuous ver-

ticals has been demolished, and the coal bunkers lowered and re-used as coke hoppers for local and railway sales, providing a total storage capacity of 110 tons.

Superimposed upon these modified bunkers is a West reciprocating coke-grader, which receives its coke via a band conveyor, from the lip-bucket conveyor encircling the bench. The coke hopper is divided into suitable compartments for the division of coke of the various sizes (*a*) dust, (*b*) ¼ in.-¾ in., (*c*) ¾ in.-1½ in. nuts, and (*d*) large coke. Outlet shoots are arranged from each section, so that either carts or railway wagons can be loaded. Screens of the cast-iron finger pattern are fitted in the bottom of the trays to pass the various grades of coke desired. The screens are tapered in both directions to clear the coke as it passes forward, resulting in freedom from choking of

The Installation of Glover-West Vertical Retorts.

the screening areas, while the grading efficiency is not materially affected. The large coke is selected at the first operation, and this reduces the amount of breakage of coke on the screen, and gives a definite and constant size of coke for sale.

Another important feature of the West coke-grader is that the size of screenings into the breeze hopper feeding the producer can be varied to give the desired amount of producer fuel by a simple alteration of the finger clearances. By this method not only the correct amount of coke smalls can be isolated for the producers, but it is of a regular graded size, a practical factor, which ensures even conditions in the producer operations and retort heating.

The coke consumers in Kilmarnock, being both private and industrial users, are no less critical in connection with their requirements than elsewhere, and, in order to meet the demand for the supply of evenly graded and clean coke, it was necessary to adopt a system of grading to ensure a reliable product for sale.

A second band conveyor delivers the coke smalls from the base of that section of the hopper into the runway skip for feeding the producers.

Waste-Heat Recovery.

As is usual in this size of installation, a waste-heat boiler is incorporated with the scheme. It is of the Spencer-Bonecourt type and is capable of generating 9000 lbs. of steam, from and at 212° F. per hour. The boiler is operated by induced draught and is equipped with the Thermofeed regulator and high and low water alarm. The combination of the breeze-burning equipment and the waste-heat boiler, which can supply sufficient steam for works purposes, provides a carbonizing unit of high efficiency as well as an increased return from salable coke.

Gas-making operations in the new plant were commenced in November, 1932, and the stipulated results have been maintained. Carbonizing results are compiled weekly, and the following is a typical illustration of the weekly returns:

Total gas made	8,531,500 c.ft.
Coal carbonized	389 tons
Gas made per ton of coal	21,931 c.ft.
Therms ,, ,,	90·1 therms
Average calorific value	410·85 B.Th.U.

The coals carbonized are obtained from Ayrshire collieries.

The annual make of gas in Kilmarnock is 364 million c.ft., and of this quantity 31·3% is sold by ordinary meter and 68·7% by prepayment meter.

The Inauguration.

The company assembled at the gas-works recreation hall for tea under the Chairmanship of Provost Henry Smith, after which they proceeded to the new plant, where Provost Smith started the machinery and set the coal and coke conveying mechanism in operation. Following an inspection of the new carbonizing installation, the company returned to the recreation hall, and several toasts were proposed and responded to after the Provost, who presided, had given "The King," which was heartily honoured.

Ex-Treasurer Blackwood, in proposing "The Gas Undertaking of Kilmarnock," said that they had always been accustomed to look upon the gas-works as one of the most successful of their public ventures. He found that, although the Undertaking was floated as a private concern away back in 1822, yet in 1870, long before many of them had begun to take an interest in municipal affairs, gas was a burning question among their predecessors in the Town Council. The electricity works were started in 1904, and he thought there were fears in the hearts of many at that time that the Gas Undertaking would suffer to some extent; but the contrary had been the case, because he found that from the inception of the electricity works the production from the gas-works had more than doubled itself. The Gas Committee had always been on the outlook for any improvements which would bring the gas-works up to date. They had had an opportunity that evening of inspecting those improvements which the Committee had just completed, and from what they had seen he was sure they must all be satisfied that there had been a successful re-organization of the works, and that they had acquired a most up-to-date plant which would serve the community for many years to come.

Bailie Bryce (Convener of the Public Utilities Committee), in replying to the toast, said that since he had been appointed to that position the Gas Undertaking was one of its branches that he had watched very carefully. Gas and electricity both had their uses. The mere fact of electricity being introduced to Kilmarnock had had the effect of bringing the production of gas to a height which it might not otherwise have reached. The Gas Undertaking could not have attained its present success if the Committee had not kept abreast of the times, and he must give credit to the various gentlemen who had served on the Committee from time to time.

Ex-Bailie Brown (Convener of the Gas Sub-Committee), in proposing "The Contractors, Messrs. West's Gas Improvement Company, Ltd.," said that shortly after the beginning of the present century vertical retorts began to take their place in the Gas Industry, and one of the pioneer firms in this respect was the firm of their present contractors, Messrs. West's Gas Improvement Company, Ltd., their special form of vertical retorts being known as the Glover-West system, the Mr. Glover of that day being a well-known gas engineer in the North of England. The Glover-West system of vertical retort carbonization had reached a point of very great efficiency, and combined within the same retort the dual process of the manufacture of gas from coal and also from coke. The contract was placed on Feb. 12, 1932, and gas making actually commenced on Nov. 10 the same year. Throughout the whole course of the contract the work had proceeded in an orderly and consecutive manner, and they knew the materials used were of the best, while the workmanship was beyond question, and from the moment that the plant was put to work the results were all that they expected, and the plant was now working and fulfilling amply all that it was specified to do. In proposing the toast of the Contractors, he had very much pleasure in coupling with it the name of Mr. R. B. Glover. He was sure that they all wished continued success to that well-known firm.

Mr. R. B. Glover, in replying, expressed regret at the absence of Alderman West and his brother, Mr. Ernest West. With regard to Bailie Brown's remarks, he appreciated his kind words and thanked him sincerely for them. He could assure them that the Firm had given them a plant which would be in every respect worthy of the Gas Industry. This job at Kilmarnock had been one of the most delightful contracts that he and his colleague, Mr. Poulson, had had to deal with on this side of the Border or anywhere else. He wished every success to the Kilmarnock Gas Undertaking and to the Town Council in all its municipal enterprises.

South African Lighting Association, Ltd.

ANNUAL GENERAL MEETING

The Forty-Fourth Ordinary General Meeting of the shareholders of the South African Lighting Association, Ltd., was held in the Association's London Offices at 48, Copthall Avenue, E.C. 2, on Wednesday, May 31, 1933—Mr. WILLIAM CASH, J.P., F.C.A. (Chairman of the Association), presiding.

The SECRETARY (Mr. William Cash, Jnr., M.A., F.C.A.) read the notice convening the meeting, together with the minutes of the last Ordinary General Meeting, held on May 25, 1932, which latter were confirmed and signed; after which the Secretary also read the Auditor's report concerning the accounts and balance-sheet.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the resolution for the adoption of the report and accounts for the twelve months ended Dec. 31, 1932, said that he was afraid that the shareholders—as well as the Directors—might consider the accounts for the past year somewhat disappointing, particularly in that they were only able to recommend the payment of a dividend at the rate of 4% instead of 5% as last year. When, however, they considered the whole position, he thought it would be agreed that this was a wise procedure having regard to the conditions ruling in South Africa during the year 1932.

It would be seen from the profit and loss account that the profit for the year, after payment of Directors' fees, amounted to £4979. To this figure had to be added the profit on exchange, amounting to £2229—which compared with £658 last year—together with two smaller sums, interest on investments, £313, and interest on deposit, £180, which gave a total of £7702. Against this they had to provide interest on mortgage debentures amounting to £1950 and Dominion income-tax, £883, after which deductions there remained the sum of £4869. The amount required for payment of their dividend was £3600, so that there was actually a surplus of £1269, which would be sufficient to pay another 1% and a little over.

On the advice of their Auditors, however, they had made another entry in this account—namely, reserve in respect of late meter-reading and discount at Port Elizabeth and Grahamstown, about £700 and £200 respectively. Some of the gas was sold after the close of the financial year. The suggestion was also made that they might have a bigger reserve for discounts, which were modified during 1932. Having made these deductions they still had an advantage in the carry-forward amounting to £365 more than in the previous year.

If it had not been for the fact that the year's profit included the profit on exchange, Mr. Cash said he did not think that they would have dealt with the accounts in this way and might have paid a larger dividend. But it seemed to be a good opportunity to set up this reserve fund and pay the smaller dividend which they suggested—namely, 4%.

A REDUCTION IN THE PRICE OF GAS.

Shareholders would like to know, proceeded Mr. Cash, why the results of the Association did not compare more favourably with those of the previous year, because in 1931 the profit had been £6700. This was due to a variety of circumstances. A year ago they reduced the price of gas—in October, 1931—and that only affected the year 1931 to the extent of three months. This reduction was equal to a total of £1000 per annum, so that when comparing the year 1932 with 1931 there was a reduced income of £750. In addition, they had not done so well in regard to residuals; their coke profits were down at Port Elizabeth and only very slightly increased at Grahamstown; tar was down at both places, as also were sales of fittings. Then there had been a decreased sale of gas at both Stations, which was an average decrease over all consumers. This looked as though it was due to the state of trade and was evidence of consumers' attempts to economize in regard to the use of gas.

Then they had been adversely affected by the price of coal. The Government had put on an additional rail freight, which, together with variations in the price, accounted for an increased cost of 1s. per ton at Port Elizabeth and 7d. per ton at Grahamstown. It was, on the other hand, encouraging to note that the number of consumers showed an increase at both Stations. At Port Elizabeth they had a substantial increase in the number of prepayment consumers, though a slight decrease in ordinary, making a net increase of 19; while at Grahamstown, where competition with electricity was very keen, they had 31 more consumers. These were the first increase figures since 1926, and showed that Mr. Coulson was undoubtedly doing very well at Grahamstown. Mr. Coulson had succeeded Mr. H. H. Hart, to whose death reference had been made at their last meeting.

Their leakage figures at Port Elizabeth were, unfortunately, no better. They had had some substantial leakages and had sent out special apparatus for dealing with the matter, which certainly seemed to have had some effect, because for the first quarter of the present year the leakage figure was down. At Grahamstown they had had a serious breakage in one of their mains, so that the leakage figure in 1932 was substantial. It was, however, much better for the first quarter of 1933. They made a claim in respect of the breakage to the Corporation, with the result that they had recovered between £60 and £70, which would be brought into the 1933 accounts.

Their London Office expenses were about the same. The Directors were still drawing their reduced fees of £500 mentioned in the profit and loss account. It would be observed that their money position was satisfactory, their investments at £6786 standing at Dec. 31 last at a value of nearly £1000 more than they gave for them. The cash position was also satisfactory, there being some £12,000 in liquid assets immediately available.

Their Auditor had repeated the observation he made a year ago when he said, "Subject to the adequacy of the renewal fund . . ." This was merely to safeguard himself as he could not test the state of this fund. They were adding to this fund, and it had increased during the year by £556.

THE FUTURE.

In regard to 1933 they had received a report recently from South Africa, and they were glad to learn that the plant at both their Stations was in a very good state of repair; but he could only say of this year that there seemed to be no immediate signs of improvement in the state of affairs in South Africa. At Port Elizabeth the decreased sales still continued, and the report of their Manager indicated no improvement. At Grahamstown, however, the Manager reported a more favourable outlook. A cheering feature of the past fortnight had been the holding of a gas exhibition, as a result of which the Port Elizabeth Station had cabled home for 120 gas cookers, which, apparently, they hoped to dispose of.

Mr. Cash said that he had been reading the report in the "GAS JOURNAL" of the Annual Meeting of the Cape Town and District Gas Light and Coke Company, and in his address to the shareholders Mr. Lilley might almost have been talking about Port Elizabeth and Grahamstown. The same troubles seemed to be affecting both Undertakings; their coal cost more; there was a decrease in sales of gas; fittings were down; residuals were down; and the consumption per consumer was less. The Cape Town Company, however, had lost 2% of their consumers. They, like their Association, had made a large profit on exchange, which would not recur; Mr. Lilley also emphasized the state of trade in Cape Town; and his Company also had had to pay a reduced dividend for the past few years. All this pointed to the adverse circumstances which would affect their immediate future.

Looking forward to the current year, they must face the fact that they would not have the profit on exchange; but, allowing for exceptional expenditure, they hoped to pay their 4% dividend again next year; and when the demand for more gas came they had works and mains ready to supply it. Competition with electricity was very severe and continued so; but he thought that there was plenty of room for a gas supply, particularly for cooking, heating, and water heating alongside the electrical undertaking. He did not think there was anything more he need trouble them with; the accounts spoke for themselves, and he hoped they would approve of the Directors taking a cautious attitude in regard to the dividend this year. With these words Mr. Cash formally moved the adoption of the report and accounts.

Mr. HENRY WOODALL, J.P., M.Inst.C.E., seconded the resolution, which was carried unanimously.

DIVIDEND.

The CHAIRMAN then moved the payment of a dividend for the year at the rate of 4%, less income-tax at 3s. 4¾d. in the £, which was seconded by Mr. JESSE F. SCOTT, A.M.Inst.C.E., and unanimously agreed to.

RE-ELECTION OF DIRECTOR AND AUDITOR.

The CHAIRMAN thereafter said it gave him great pleasure to move that Mr. Henry Woodall be re-elected one of their Directors. It was superfluous to say anything in that room or anywhere in the Gas Industry about Mr. Woodall. He was of very great value on their Board; he went to South Africa some years ago, and was responsible for the erection of their Grahamstown Works, while his knowledge of the affairs of the Industry generally was very wide.

Mr. T. N. G. JENNINGS seconded the resolution, which was unanimously carried, and, in acknowledgment,

Mr. WOODALL said that this had always been a very pleasing Company to be connected with. In the days when he was in South Africa they used to pay their 10% dividends regularly. During the past few years, however, they had not been able to do so well. In those days there was no electrical competition, which was now very severe in South Africa as they knew. It was a municipal supply, and their Manager had great difficulty in obtaining new consumers. But in spite of this they were get-

ting new consumers, though the ones they had were using less gas; but he hoped that better times were coming.

The Association's Auditor, Mr. Percival D. Griffiths, F.C.A., was re-elected at the usual fee of 40 guineas, on the proposition of Mr. F. R. SMITH, seconded by Mr. W. ARNOTT.

VOTES OF THANKS.

The CHAIRMAN then expressed thanks to the officers and staff both in London and South Africa for their work during the year. Their thanks were due to them more in these difficult times than in easy times, and he would like to propose a vote of thanks to cover them all, and this would be transferred to South Africa in the usual way.

Mr. ARNOTT seconded the vote, which was unanimously carried.

Mr. SMITH said he was sure they would not like to leave without expressing a very hearty vote of thanks to the Chairman and Directors for their services in the difficult times through which they were passing. They were looking after the interests of the Association in the best possible way.

Mr. J. DONALDSON seconded the vote of thanks, which was heartily accorded.

The CHAIRMAN, in acknowledging the vote, remarked that it was true to say that the more difficult the times more attention, thought, and care was needed. He was fortunate in having on the Board with him gentlemen like Mr. Woodall, to whose value he had already referred, Mr. Scott, who dealt with the correspondence which was carried on every week between their London Office and the South African Stations, and Mr. Jennings, whose wide experience in banking matters was very valuable. They hoped that something would be done to reduce the duties on imports in South Africa and to help trade there generally. If this were done they might hope to look forward to more prosperous times.

This concluded the business of the meeting.

Sunderland Gas Company's Special Order

(House of Lords: Before Lord MESTON *(Chairman), Lord* SANDYS, *Earl* MORAY, *Earl* CAWDOR, *and Lord* CARNOCK.)

(Concluded from p. 631 of last week's "JOURNAL.")

Mr. *Thomas Summerbell*, a member of the Sunderland Town Council, giving evidence against the Order, said that the shipping, shipbuilding, and marine engineering industries, upon which the town was largely dependent, had been very depressed for a number of years; in the financial year 1930-31 the rate in the pound for poor relief purposes was the second highest in the country, and unemployment had increased 50% on the 1930 figure. A great number of industries in Sunderland had been paying declining dividends, if any at all, and in view of these circumstances there was a strong feeling there against granting at this time the powers sought by the Gas Company. He claimed to be speaking on behalf of consumers of gas.

With regard to the possibilities of the Company obtaining further supplies of coke oven gas, he said there were about twenty collieries within a 10-mile radius of Sunderland, the majority of them producing a class of coal which could be coked; and he saw no reason why, in better times, they should not install coke ovens. There was no doubt that in normal times the demand for gas would increase, so that an increased quantity of coke oven gas could be used, and colliery owners might be stimulated to come into the market.

It was the view of the Corporation that if there were to be a basic price applying to the Company it should be one which should allow advantages to the Company only in respect of enterprise displayed in the future.

Mr. WROTTESLEY, cross-examining, pointed out that when the Corporation had considered opposing the Order, 34 members had voted for opposing it, and 22 had voted against opposing. He asked if the decision to oppose was based on some members disliking what was called "capitalism."

Mr. *Summerbell* said that it was not. He agreed that the Corporation owned an electricity undertaking, but that it would be improper to prevent the Gas Company obtaining industrial business, and that from the point of view of the consumer it would be desirable that the Gas Company should be encouraged to obtain such business.

Mr. WROTTESLEY, in regard to further supplies of coke oven gas, said the Company had applied to all the collieries with coke ovens within fifteen miles, but could get no more coke oven gas than it had already arranged for.

Mr. *Arthur Valon* (Mesrs. W. A. Valon & Son, Consulting Engineers, Westminster) gave evidence for the Corporation. Referring to the small capital expenditure of the Company, he said that the Company was in an extraordinarily fortunate position, particularly if the basic system were applied, because the smaller the capital the higher was the percentage remuneration on that capital when a given amount of money was distributed. The unexercised borrowing powers, amounting to nearly £100,000, were sufficient to enable the Company, if it desired, to extend its business very largely without increasing the ordinary capital which would have to be remunerated under the basic system.

He had accepted figures for a number of items put forward by Mr. Evetts as being normal; but in some cases there was a considerable difference between the suggested normal figure and the ascertained figure for 1932, so that in the first year after the basic price had been fixed notionally there were considerable fluctuations. For instance, expenditure on repairs of mains was one case.

With regard to the suggestion of the Corporation that in estimating a basic price the immediate possibilities with regard to supplies of coke oven gas should be considered, Mr. Valon said he had never before met the suggestion that a company should have the advantage of savings which had accrued before the date on which the new system came into operation.

Mr. TURNER asked if witness considered the present a suitable time to apply the basic system, bearing in mind the evidence of depression in Sunderland, and the evidence in regard to future industrial revival and increased take of coke oven gas.

Mr. *Valon* considered there were too many doubtful factors at present, and it would be better for the Company to carry on for the next few years until things settled down. The basic price in Sheffield was fixed at a figure below the price at which gas was being sold at that time, the reason for the low basic price being that the Sheffield Company was then taking coke oven gas to the extent of about 10% of its supplies and was expected to take a great deal more.

If the Sunderland Order were applied there would be an immediate increase of dividend authorized, even though there might be no reduction made in the price of gas. There were matters of uncertainty, particularly in regard to operation of works, and in deciding how far it was affected by coke oven gas and other factors.

Mr. Valon exhibited a table showing that, on the working results in 1932, if the Order had been in force, with a basic price of 6d. per therm, the authorized dividend would have been £6 9s. 7d.%, and the money was available for the payment of that dividend. The balance of profit, after paying the basic dividend in 1932, would have been £7749. The cost of the extra dividend and the co-partners' share would be £3339, leaving a surplus of £4410 available for funds or other purposes.

Had the basic price been 6½d., as at first proposed by the Company, the dividend authorized would have been greater, of course.

Mr. WROTTESLEY, cross-examining, asked if it were considered that the Directors would have done what was indicated by the table, bearing in mind the history of the Company.

Mr. *Valon* said he could not tell, but he saw no reason why they should not.

Mr. WROTTESLEY said that the renewal and special purposes funds were left out.

Mr. *Valon* replied that he had shown a figure of £4410 available for funds.

Mr. WROTTESLEY said it had been stated by Mr. Evetts that it was time money was put into the renewal fund, that the amount added to it annually should be equivalent to 1% of the paid-up capital, and a similar amount to the special purposes fund; Mr. Evetts had allowed for those contributions.

Mr. *Valon* said he was not in a position to judge as to the necessity, and in any case the usual practice was to apply money to the funds in a good year, and not necessarily in a bad year. He considered that these funds ought to be left out of consideration; he would not necessarily advise a company to commence appropriating money immediately to both those funds, but to appropriate money as opportunities arose.

Mr. WROTTESLEY said that if it were wise in the circumstances to appropriate the money at once, the amount to be set aside in the year 1932 would be £7000 (on the basis of 1% of the paid-up capital to each fund), so that on the 1932 figures there would be nothing left for the payment of extra dividends.

Mr. *Valon* said the Company could have paid more into reserve fund than they had done during the last five years, instead of paying maximum dividends.

Mr. WROTTESLEY: Or instead of charging so little for gas!

With regard to the statement that in regard to capital the Company was in an extraordinarily fortunate position, Mr. Wrottesley suggested that the consumers were also.

Mr. *Valon* agreed.

Wednesday, May 24.

Mr. S. G. TURNER, K.C. (for the Corporation), said the broad and general ground of his case was that the position at the date when a basic price was fixed should approximate so nearly to the normal position and should be so free from exceptional uncertainties as to make it possible to determine a fair, normal, average price for future working.

It was plain, said Mr. Turner, that the Sunderland Company, in asking for the application of the basic system, was not asking for something which was in any sense common form. Although something like half the quantity of gas supplied in the country was supplied under the basic system, that was due only to the fact that one or two of the very largest companies, such as

the Gas Light and Coke Company, were operating under the system; only about 10% of the number of gas companies in the country were operating under the system.

Four distinct factors which must be considered in arriving at a fair average basic price to which the Company could be expected to work to in the future were the known relevant facts of the past; the necessary adjustments of the figures for the year under consideration in order to represent normal conditions; known facts as to the future which might not have been operating in the past (and he emphasized this matter because of the contract by the Sunderland Company for the supply of coke oven gas); and whether there were such elements of uncertainty in the situation as to render it impossible to fix a fair average price.

In this latter connection there were two further considerations—first, the industrial situation in Sunderland and the consequent impossibility of knowing what would happen in the future; and, secondly, the impossibility of estimating the quantity of coke oven gas which the Company might receive in the future. Although it had been stated by Mr. Evetts, in evidence, that the Company had not the first call upon the coke oven gas from the colliery company supplying it, there was not a word in the contract about that. It was a clear contract for the supply of 450 million c.ft. of coke oven gas each year for the next fifteen years, and it provided that after a total of 7500 million c.ft. had been taken the price was to be reduced. Another provision was that in the event of the colliery company at any time being able to supply more than the stated yearly quantities, the Gas Company should have the option of taking an additional supply at rates to be mutually agreed. Obviously, what was contemplated was not a small increase on the 450 million c.ft. per annum, but something substantial.

If the industrial revival came, and there were increasing sales of industrial gas, all of which would be at below the ordinary price of gas, the effect of those sales would be to reduce the average price of the total gas sold; if the basic price were fixed on to-day's circumstances there would be a corresponding increase in the permissible addition to the basic dividend. If there were also an increased take of coke oven gas, the Company's costs would be smaller as a result, which implied that there would be more money in the till with which to pay the increased dividend. If the Company chose to finance extensions by borrowed money, the capital to be remunerated would remain at the present small amount, so that the division of a given sum as excess dividend would represent a higher percentage than if the capital were larger.

Of course, it would be said that these matters would benefit the consumers; that was inherent in the basic system. The Company, however, was not promoting the Order in the interests of the consumer, except that it had to look after the interests of the consumer so far as it was its business to do so. The primary consideration was to do the best for the shareholders. Counsel submitted that all this change would not be accompanied by benefit to the consumer. There was no benefit to the consumer if the Company found itself in a position to pay increased dividend without reducing the price of gas. It was proposed to fix the basic price at a higher figure than the net selling price, whereas in the Sheffield case, although the then selling price was more than 8d., the basic price was fixed at 7d.

With regard to the renewals and special purposes funds, the maximum amount that could be allocated to each in any year was equal to 1% of the paid-up capital. These were funds which in practice could be built up in good years and depleted in bad years, but Mr. Evetts, in his calculation, had assumed that the full 1% would be paid into each fund in each normal year.

Counsel questioned the propriety of bringing into the calculation of the basic price a figure representing savings effected in 1932, to the advantage of the Company, the great part of which savings was due to the use of coke oven gas. It was extremely dangerous to introduce the principle of adding as an element in the building-up of the basic price a saving which the Company had effected more than a year before the basic price would come into operation. Mr. Valon had never known that to be done before, and Mr. White, who had given evidence for the Company, although he also had not known it to be done, had sought to justify it by saying that the Company might have promoted the Order before making the coke oven gas contract. But even if it were right that some figure ought to be included, there was the impossibility of determining the proper figure. It was significant that, at the Board of Trade inquiry last November, Mr. Evetts had arrived at a basic price figure of 6½d. per therm, but that now he arrived at 6d. That in itself seemed to show that there was some considerable difficulty in fixing a figure, even apart from the uncertainty of the future.

Mr. WROTTESLEY pointed out that the 6½d. put forward in November was arrived at by a calculation which included ¼% dividend not in the later calculation.

With regard to the suggestion by the Corporation that an area which is to be added to the Borough should be supplied with gas at the same price as the existing Borough area, Mr. Turner said the Company had stated that the area to be added was virgin land. The circumstances were that the Corporation had a housing estate immediately adjoining, and an extension of that estate was in contemplation—although there was no resolution in regard to it—on to this land. Thus, the land would be covered with houses, so that the Company's objection to placing it within the " inner area " for gas supply purposes would no longer exist. It would be inconvenient if the occupiers of the houses on this small area, comprising only 129 acres, had to pay more for their gas than occupiers of houses " just across the road."

Dealing with the proposed transfer of £11,000 from the existing reserve fund to the new reserve fund—about which the Committee had asked for further explanation—Mr. Turner said he gathered that that sum would be available for increasing the permissible dividend in a given year. The existing reserve fund, in which that sum was now included, was available only to maintain the dividend within the statutory maximum, but not beyond that. The Corporation urged that it should not be used for paying dividends above those permissible statutorily, and that it might be transferred to the renewal fund.

Mr. WROTTESLEY admitted that perhaps there was something in the Corporation's argument with regard to the £11,000, and he suggested a provision that that sum, when transferred to the new reserve fund, should not be used to pay dividends greater than the rate authorized under the basic system in any year. The Company was anxious to retain the money, however, to be used for the maintenance of the authorized dividend in the event of there being insufficient revenue to pay the full dividends owing to the low price of gas.

(The Corporation agreed to this course.)

DECISION OF THE COMMITTEE.

The decision of the Committee was that, subject to the agreement arrived at by the parties concerning the £11,000 in the old reserve fund, the Order should go forward.

Chester Gas Order

Application Under the Gas Regulation Act

An Inquiry was held at the Offices of the Board of Trade in London on Tuesday, May 23, into an application by the Chester United Gas Company for an Order under the Gas Regulation Act, the object of which is to extend the limits of supply, to consolidate and extend—to a small extent—the Company's borrowing powers, and generally to bring up-to-date the Acts and Orders under which the Company is now operating.

Mr. J. F. RONCA, the Director of Gas Administration, held the Inquiry, and the Chester Corporation and the Hawarden Rural District Council opposed. Mr. H. Royston Askew (Barrister) appeared for the Company; Mr. M. Lindsay Taylor (Deputy Town Clerk) represented the Chester Corporation, while the Hawarden Rural District Council was represented by its Clerk, Mr. A. H. Wroe.

Mr. ASKEW, on behalf of the Gas Company, referring to the proposed extension of limits of supply, pointed out that these included additional parishes in the counties of Chester and Flint, the Urban District of Hoole, the Rural District of Chester, and the Rural District of Tarvin, these extensions containing a number of villages and centres of population in which great development was taking place and in which there was not only no gas supply at the present time, but there was no possibility of a supply being given except from Chester. It was also added that these extensions constituted a natural extension outwards of the existing limits of supply. In one portion of the proposed extension of area the Connah's Quay Gas Company had statutory powers to supply, but these had never been exercised, and by agreement with that Company the Order proposed to repeal these powers and give the Chester Company the right to supply.

Speaking of the differential price now existing in the Company's area, Mr. Askew said that outside the 2½-mile radius of the gas-works in Chester there existed a differential 1·2d. per therm, and it was proposed to maintain this same differential in the additional area proposed. Clauses 14 to 21 of the Order consolidated the various borrowing powers now possessed by the Company without modifying the position except to the extent that in respect of capital issued after 1932 the Company could borrow to the extent of 60% instead of 50% as previously. The remainder of the Order, added Counsel, contained a number of clauses which brought the legislation under which the Company was operating up-to-date and in line with the policy adopted by Parliament and the Board of Trade at the present time.

THE OBJECTIONS.

Coming to the objections to the Order it was pointed out that although a number of local authorities were concerned only two had seen fit to enter objections—namely, the Chester Corporation, which raised some matters of clause detail, and the Hawarden Rural District Council, which objected to the Company having powers to supply gas in certain parishes, particularly in Sealand and East Saltney. Dealing with the latter's objection first, Counsel pointed out that the Rural District Council stated that these districts were already " adequately supplied with lighting and power." Speaking with some experience of recent gas legislation Mr. Askew said this was to him a new ground for opposition to such an Order as this, and added that it would have been more frank on the part of the

Hawarden Rural District Council if it had stated that the adequate supply of lighting and power related to electricity supplied by the Rural District Council and that there was no gas supply there at all. This fact perhaps made it easier to understand the reason for this opposition, which was, of course, to exclude the Gas Company and prevent any competition with the Electricity Undertaking. Such a suggestion, however, was completely subversive to the whole policy in legislation of this type of Parliament and the Board of Trade, which had never taken the view that because electricity was supplied in a district gas should be excluded, nor indeed, *vice versa*. As a matter of fact, had the Electricity Undertaking in the Hawarden Rural District been in the hands of a company, that company would have had no *locus standi* to appear in opposition to the application of the Gas Company.

Another interesting feature of the position was that the Hawarden Rural District Council possessed powers to supply electricity in a certain portion of the Chester Gas Company's existing area, but, at the same time, they objected to the Gas Company supplying gas in the portion of the Hawarden Rural District where electricity was being supplied by the Rural District Council. Moreover, in connection with one of its housing schemes where gas was available the Hawarden Rural District Council had used its powers as a landlord to prohibit the use of gas for lighting. With the discussion on the Kettering Gas Bill in mind and the extremely sweeping votes on this question of discrimination as between electricity and gas, Mr. Askew said he felt he need say no more on this matter.

Passing to the Chester Corporation's opposition, it was pointed out to the Director of Gas Administration that the first point raised concerned the rate of 6% interest on mortgage and debenture stock, the point being made that this was too high in present circumstances, and that 5% should be the limit. So far as the Company was concerned, however, it did not think that any limit at all was necessary, because, like every other business concern, its aim was to obtain cheap capital, and therefore the Directors were not likely to pay higher rates than those prevailing in the money market generally. That was well illustrated in the last balance-sheet of the Company, which showed that money had been raised at 3½% under the Capital Issues Consent and that a 5% redeemable debenture stock was being redeemed in order to obtain advantage of the present low rates of interest. It was true that 6% sounded a little high for 1933, but the Order was legislating for a number of years ahead, and during that time money rates might vary considerably. If, therefore, there was to be any limit at all the Company suggested the figure should be fixed at one which allowed a reasonable margin to meet possible fluctuations in the money market for a reasonable number of years ahead. The Chester Corporation also suggested that 5% should be the limit of dividend paid on preference stocks. These, however, it was pointed out, had not the same security as a debenture stock, and, therefore, it did not seem right to take the same figure in the two cases.

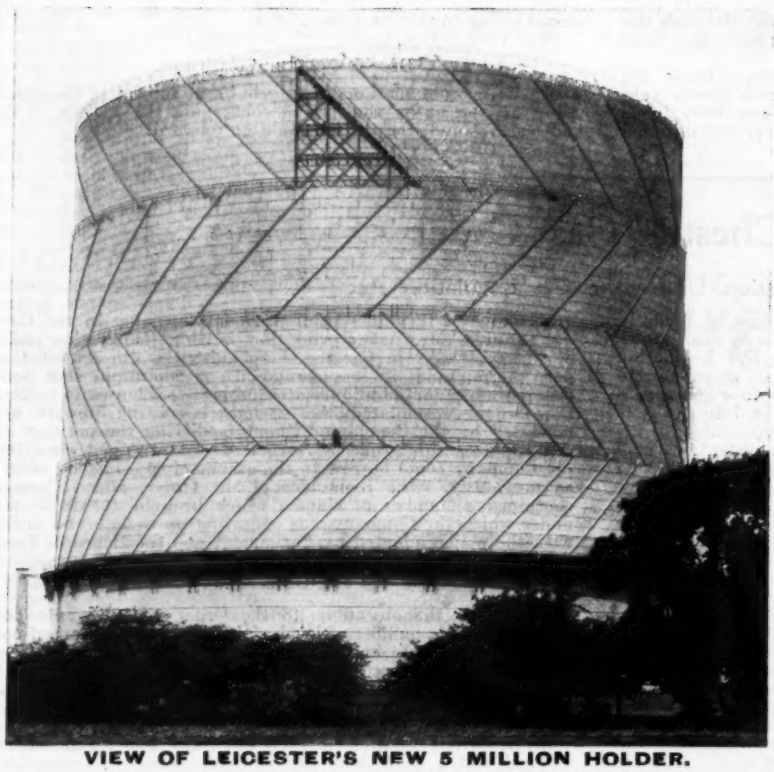
Meter Testing.

Mr. Askew then came to Clause 57 of the Order which repealed a number of the provisions under which the Gas Company had been operating for 80 years, as in the view of the Company they are obsolete and inoperative. The Chester Corporation, however, raised two points in connection with this clause relating to the appointment of an inspector for the inspection of meters and also to the testing of meters. These powers were contained in Section 65 of the Company's Act of 1858, but the question arose as to whether the Sale of Gas Act of 1859 did not impliedly repeal the powers in this respect which had been conferred upon the Chester Corporation by the Company's Act of 1858. If that were so the Corporation of Chester at the present moment did not possess the powers which the Company now proposed to repeal, and it was submitted that the Board of Trade, in that event, could not restore those powers to the Corporation which desired to continue to possess them. Moreover, Mr. Askew said he was not aware that the Corporation had ever appointed an inspector of meters.

Mr. Taylor (Deputy Town Clerk, Chester Corporation) said he did not think that had ever been done.

Mr. Askew agreed that this fact might not affect the law, but, he added, it might affect the merits of the position of the Corporation in regard to the present Order.

Another section of the Company's Act of 1858 which it was proposed to repeal was Section 72, which authorized the Company to erect a testing meter at their works and also to maintain and keep in repair a testing apparatus erected at the Exchange as it existed in the year 1858. Mr. Askew asked the Director to note the meticulous exactitude of the wording of this section of the Act of 1858, which placed upon the Company the obligation to maintain a testing station at the Exchange, and added that, in point of fact, the Exchange was burned down many years ago, and the site at the present moment was part of an open market-place. He, therefore, contended that the powers contained in Section 72 of the Act of 1858 had obviously lapsed owing to the disappearance of the subject matter on which they turned. Nevertheless, the Corporation of Chester objected to the repeal of this section. As being relevant to this matter, Mr. Askew drew attention to the fact that the whole system of testing meters has been re-organized by the Gas Regulation Act of 1920 and placed in the hands of the Gas Referees, and that under this Act there must be a testing place "provided by the undertaking." At the present moment, however, there was no such testing place, and the Company therefore contended that the Corporation no longer had any powers under Section 72 of the Act of 1858. There was, how-



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ever, a testing place in Chester at the office of the Gas Examiner appointed under the Gas Regulation Act, and he understood that the Corporation had approved of this position.

TENANTS UNABLE TO AFFORD ELECTRICITY.

Mr. *J. H. Noble* (Engineer to the Chester United Gas Company) gave evidence in support of the Order, and remarked that in some cases in the Hawarden Rural District Council, where no gas was available, the tenants using electricity had gone over to oil because they could not afford the high cost of electricity.

Mr. A. H. WROE (Clerk to the Hawarden Rural District Council) addressing the Director, said that in the parish of Sealand there were 469 houses, of which 390 were supplied with electricity. In Bretton and Broughton there were only 14 houses and two consumers of electricity. He contended, on behalf of the Hawarden Rural District Council, that the area now proposed to be added to the Company's limits of supply—so far as the Hawarden Rural District was concerned—was mainly agricultural and that there was no possibility of making gas supply an economic proposition. On the other hand, the competition of gas with the Council's Electricity Undertaking would be harmful to it and prevent electricity being supplied at as cheap a rate as would otherwise be possible. The Rural District Council, he said, had spent £125,000 on the erection of transmission lines throughout the district and about one-fifth of this had been spent in the Sealand area. At the present time the Gas Company had powers to supply in parts of the Hawarden Rural District, but had not exercised these powers. The Gas Company's area at present included 4875 acres in the rural district of which only 600 acres had been supplied with gas, yet it was now proposed to add another 5115 acres. It was only after the Rural District Council had developed its Electricity Undertaking that the Gas Company came along and sought to compete. So far as the existing supplies of gas in the rural district were concerned, the Council did not object to gas being used for heating and cooking on its housing estates, but it objected to gas being used for lighting purposes.

Mr. ASKEW questioned Mr. Wroe to the effect that the Gas Company's proposals to give a supply in Sealand were the outcome of an application from the tenants in that district, and this was agreed to be the case. Mr. Askew also put the question that the object of the Rural District Council's opposition was to keep the Gas Company out and prevent competition, and eventually Mr. Wroe agreed this was so.

Mr. *J. E. Bennett* (Chairman of the Hawarden Rural District Council Electricity Committee) said the Undertaking which had been in existence for about seven years was run as a business concern, and was in no way supported by, or chargeable to, the rates. The Hawarden Rural District Council, he said, was one of the very few rural district councils which had acquired powers to distribute electricity, and it was not until they had spent £125,000 in giving this supply that the Gas Company came along and proposed to extend its limits of supply and to compete, notwithstanding that it had powers over a large area in the rural district which had not yet been exercised. Mr Bennett concluded by expressing the view, which was definitely held by his Council, that there was no room for a competing system in the rural district.

Mr. TAYLOR (Deputy Town Clerk to the Chester Corporation) then addressed the Director in regard to the points that had been raised by the Chester Corporation, mentioning that the Corporation and the Gas Company always worked in the most amicable manner. Nevertheless, he said, there were occasions such as the present when the Corporation felt it their right to bring forward matters for consideration in the interests of the ratepayers.

The DIRECTOR: It is your right and your duty.

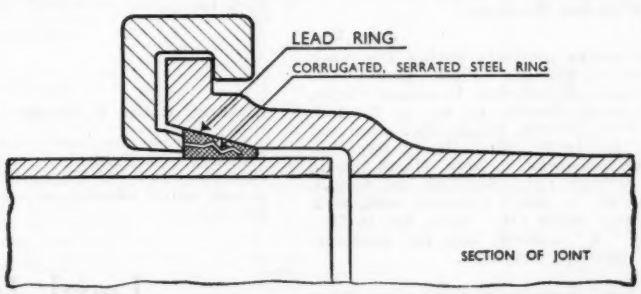
Mr. TAYLOR, briefly dealing with the question of the rate of interest, maintained the point that a limit of 5% should be fixed on debenture and preference stocks, and added that if at any time it was found conditions had changed which justified a higher rate of interest the Company could always apply to the Board of Trade to have the figure modified. Certainly at the present time 6% was too high a limit in the view of the Corporation. Taking up the point made by Mr. Askew that by reason of the higher security of a debenture the same rate of 5% could not very well be applied to a preference stock, Mr. Taylor drew attention to the fact that a figure of 6% had been taken by the Company in the Order for both classes of stock. Finally, dealing with the position concerning the appointment of inspectors and the maintenance of a testing station at the Exchange, Mr. Taylor asked the Gas Administration Department to take advice in order to clear up the legal position with regard to this, adding that there was grave doubt as to whether the Town Hall at the present time did not stand on the site of the old Exchange, and that certainly the testing apparatus was continued for some time in the Town Hall after the burning down of the Exchange.

Mr. ASKEW expressed his appreciation of what Mr. Taylor had said as to the amicable relations existing between the Corporation and the Gas Company. Commenting on the opposition of the Hawarden Rural District Council, he said this was clearly a case in which a local authority owning an electricity undertaking wished to prevent competition from gas. Such an attitude, however, was contrary to the policy that had been adopted by Parliament throughout the whole history of gas and electricity, and it would be a distinct departure if such a view were accepted now. There was, added Mr. Askew, a considerable potential demand for gas in the proposed extensions of the Company's area in the Hawarden Rural District.

The Inquiry then concluded, and the Board of Trade will report in due course.

The STANTON Mechanical Lead Joint

(Patent applied for)



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This mechanically made joint works on a similar principle to the Stanton-Wilson Joint, but employs a lead ring in which is encased a thin corrugated, serrated steel ring. It is more flexible than a caulked joint and provides for expansion and contraction of mains—No skilled labour needed.

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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The chief feature on the Stock Exchange last week was the wide fluctuations in South African gold-mining shares brought about by the uncertainty as regards that country's new taxation proposals. Gilt-edged securities, stimulated by the success of the Australian conversion scheme, showed appreciable strength, and while there was a certain amount of profit-taking in industrial shares the general tone was steady at the close on Friday. Money continues exceptionally cheap, and the large amount available was reflected in a new low record at which Treasury Bills were allotted—viz., 5s. 11·18d.%.

The volume of business in Gas stocks and shares was somewhat easier last week, though with few exceptions prices remained unchanged. The local popularity for the stocks of the Provincial undertakings was instanced in the case of the Chester 5%, which gained 5½ points on the Liverpool Exchange to 105-110, and on the basis of a 5¾% dividend—the rate paid for many years—the yield at this price is a comparatively high one at £5 6s. 11d.%. On the same Exchange, Liverpool ordinary rose a fraction to 126. Newcastle units were also in demand, and fully recovered the previous week's drop of 6d. to 25s., and the 3½% debenture moved up a point to 92. On the other hand, Gas Light 3% debenture eased 1½ to 78½; South Metropolitan ordinary and two preference stocks all fell a point; and Brighton 6% "B" preference dropped 3 to 135½.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *June* 2.

The position of the tar products market is as follows:

Pitch is quiet as is usual at this season of the year, and the price is called about 85s. per ton f.o.b.

Creosote is firmer at about 3d. per gallon as this article is proving of interest for fuel purposes.

Refined tar is about 4d. to 4¼d. per gallon in bulk at makers' works.

Pure benzole is about 1s. 9d. per gallon, and solvent naphtha, 95/160, about 1s. 6d. to 1s. 7d. per gallon; both of these products having eased in sympathy with petrol. Toluole, on the other hand, maintains its firmness, and is steady at about 2s. 4d. per gallon. Pyridine bases, 90/140, are about 3s. 9d. per gallon naked at makers' works.

Tar Products in the Provinces.

June 3.

The average prices of gas-works products during the week were: Gas-works tar, 32s. 6d. to 37s. 6d. Pitch—East Coast, 80s. to 82s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 80s. to 82s. 6d.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6d. to 6¼d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 5d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2d. to 2½d.; low gravity, 1½d.; Scotland, 2d. to 2¼d. Heavy oils, in bulk, North, 4d. to 4½d. Carbolic acid, 60's, 2s. 9d. to 2s. 10d. Naphthalene, £9 to £10. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. per minimum 40% purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *June* 3.

New business is not too plentiful, but throughput is fairly steady. Practically no forward contracts are being arranged at present.

Crude gas-works tar.—The actual value is 42s. 6d. to 47s. 6d. per ton *ex* works.

Pitch.—While the forward position is receiving attention, few buyers are prepared to contract at present. Export value is nominal at 75s. to 77s. 6d. per ton f.o.b. Glasgow. In the home market, value is steady at 75s. per ton *ex* works in bulk.

Refined tar to Ministry of Transport Specification is well maintained at 3¼d. to 3¾d. per gallon f.o.r. naked, according to quantity.

Creosote oil.—Supplies are plentiful, and consequently prices are irregular. B.E.S.A. Specification is 2¼d. to 2¾d. per gallon; low gravity, 2d. to 2½d. per gallon; and neutral oil, 2½d. to 2¾d. per gallon—all in buyers' rail tanks *ex* works.

Cresylic acid shows little or no change with quotations weak. Pale, 97/99%, is 10d. to 11d. per gallon; dark, 97/99%, 9d. to 10d. per gallon; and pale, 99/100%, 1s. 1d. to 1s. 2d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha is still quite firm at 4d. to 4¼d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 2½d. to 1s. 3¼d. per gallon, and 90/190 grade 11d. to 1s. per gallon *ex* works.

Motor benzole.—While supplies are not plentiful value is lower at 1s. 3d. to 1s. 4d. per gallon *ex* works in bulk.

Pyridines.—90/160 grade is 3s. to 3s. 3d. per gallon, and 90/140 grade 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	9	to	0	9½	per gallon at works
Motor ,,	1	4	,,	1	4¾	,, ,, ,,
Pure ,,	1	7½	,,	1	8	,, ,, ,,

Contracts Advertised To-Day.

Coal.

Belfast Corporation Gas Department. [p. 778.]
Birstall Urban District Council. [p. 778.]
Hebden Bridge and Mytholmroyd Gas Board. [p. 778.]

Storage Tank.

Blackburn Gas Department. [p. 780.]

Vertical Chamber Ovens.

Stalybridge Gas Department. [p. 778.]

New Capital Issues.

Bideford Gas and Coke Company, Ltd.—The tenders for the £18,500 4½% redeemable debentures, which were offered on behalf of this Company were opened on June 1. They amounted to a total of £45,000 at prices ranging from £105 per £100 down to the minimum of par. The lowest accepted tender was at £101 5s. 6d. per £100, and the average price obtained £102 10s.%.

Trade Notes.

Kirkham, Hulett, & Chandler, Ltd.

An order has been placed by the Coal Distillation Plant, Cannock, Staffordshire, with Messrs. Kirkham, Hulett, & Chandler, Ltd., of Union Foundry, Mansfield, for a 2 ft. 6 in. patent spiral centrifugal washer of a capacity of 350,000 c.ft. per day.

Legal Intelligence.

Tar Distillers, Ltd.

In the Chancery Division, on May 29, Mr. Justice Bennett confirmed the reduction of capital of Tar Distillers, Ltd., from £100,000 to £80,000, the amount of the original capital being in excess of the Company's requirements. The £20,000, it was stated, would be returned to the shareholders.

Steatite and Porcelain Products, Ltd.

A petition for reduction of the capital of Steatite and Porcelain Products, Ltd., a Company mainly concerned with the manufacture of articles for incandescent gas fittings, was granted by Mr. Justice Bennett in the Chancery Division on May 29. The reduction was from £400,000 to £104,000, and it was stated that the scheme had been approved by the shareholders.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations June 2.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 3	7⅝	7	Alliance & Dublin Ord. ...	117—127	...	120
374,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb. ...	85—95	...	...
557,655	,,	Mar. 6	7	7	Barnet Ord. 7 p.c.	157—162	...	161
300,000	1	May 8	1/4⅛	1/9⅛	Bombay, Ltd.	25/—27/-	...	...
178,280	Stk.	Feb. 20	9½	9½	Bournemouth sliding scale	195—205	...	200—202
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	157—162	...	159
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	137—142	...	...
50,000	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	101—106	...	...
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
357,900	,,	Mar. 6	7½	7½	Brighton, &c. 6 p.c. Con. ...	152—157	...	...
540,000	,,	,,	6½	6½	Do. 5 p.c. Con. ...	141—146	...	...
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	134—137	−3	3135—137
1,487,500	,,	Mar. 6	5	5	Bristol 5 p.c. max.	112—114*a*	...	...
120,420	,,	Dec. 19	4	4	Do. 1st 4 p.c. Deb. ...	100⅜—101⅛*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100⅜—101⅛*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	120—124*a*	...	...
855,000	,,	Apl. 3	7	8	British Ord.	147—152	...	148—151
100,000	,,	Dec. 19	7	7	Do. 7 p.c. Pref.	147—152	...	...
350,000	,,	,,	—	5½	Do. 5½ p.c. Pref. ...	105—110	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	105—115	...	...
160,000	,,	Jan. 9	5	5	Cambridge 5 p.c. Deb. ...	117—122	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	7—8*	...	7½
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref. ...	6—7	...	...
150,000	Stk.	Dec. 19	4½	4½	Do. 4½ p.c. Deb. ...	88—93	...	...
626,860	,,	Feb. 20	6	6	Cardiff Con. Ord.	119—124	...	...
237,860	,,	Jan. 9	2½	5	Do. 5 p.c. Red. Deb.	105—110	...	...
157,150	,,	Feb. 20	5	6½	Chester 5 p.c. Ord.	105—110*b*	+5½	...
98,936	1	May 22	2/-	2/-	Colombo, Ltd. Ord.... ...	25/—30/-*	...	29/9
24,500	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	18/6—20/6*	...	...
609,204	1	Mar. 20	/11 48	/11 48	Colonial Gas Assn. Ltd. Ord.	17/—19/-	...	...
296,053	1	,,	1/3'30	1/3'30	Do. 8 p.c. Pref.	20/—22/-	...	...
1,796,955	Stk.	Feb. 20	5	6½	Commercial Ord.	112—117	...	116—116½
475,000	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	,,	Feb. 20	7	7	Croydon sliding scale ...	145—150	...	...
469,590	,,	,,	5	5	Do. max. div.	101—106	...	103—104
500,000	,,	Jan. 9	5	5	Do. 5 p.c. Deb.	120—125	...	...
542,270	,,	Mar. 6	7	10	Derby Con.	150—160*c*	...	...
55,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	80—85*c*	...	...
209,000	,,	Mar. 6	5	5	East Hull Ord. 5 p.c. ...	106—111	...	...
179,500	,,	Mar. 6	6	6	East Surrey Ord. 5 p.c. ...	120—125	...	...
155,019	,,	Dec. 19	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
1,002,180	,,	Apl. 3	15	17	European, Ltd.	130—135	...	130—133½
19,373,992	,,	Feb. 20	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	25/—26/-*f*	...	25/6—25/10½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max. ...	86—89	...	86½—88
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	99—102	...	100—101½
6,102,497	,,	Dec. 19	3	3	Do. 3 p.c. Con. Deb. ...	77—81	−1½	79—81
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	115—118	...	115—116⅜
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	112—115	...	112—113⅜
270,466	,,	Mar. 6	6	6	Harrogate New Cons. ...	113—118	...	...
82,500	,,	Mar. 6	7	7	Hastings & St. L. 5 p.c. Conv.	138—143	...	140
258,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	110—115	...	112½—114½
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd. ...	14—15	...	...
213,200	Stk.	Mar. 6	6	6	Hornsey Con. 3½ p.c. ...	122—127	...	...
5,600,000	,,	May 22	10	14	Imperial Continental Cap.	205—215*	...	207½—211
223,130	,,	Feb. 6	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	92
235,242	,,	Mar. 6	8½	8½	Lea Bridge 5 p.c. Ord. ...	170—175	...	...
2,145,907	,,	Mar. 6	6	6	Liverpool 5 p.c. Ord. ...	125½—126½*b*	+½	...
245,500	,,	Dec. 19	5	5	Do. 5 p.c. Red. Pref. ...	105—115*b*	...	...
306,088	,,	Jan. 19	4	4	Do. 4 p.c. Deb. ...	101—103*b*	...	...
165,736	,,	Feb. 20	8	10	Maidstone 5 p.c. Cap. ...	180—200	...	...
56,176	,,	Dec. 19	3	3	Do. 3 p.c. Deb. ...	70—75	...	...
75,000	5	Dec. 5	†10	†10	Malta & Mediterranean ...	9—11	...	10½
892,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Mar. 6	5	5	M. S. Utility "C." Cons. ...	103—108	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100	...	94½—97
112,126	,,	Jan. 9	4	4	Do. 4 p.c. Deb. ...	102—104	...	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
675,000	,,	21 May '31	†6	†6	Montevideo, Ltd.	50—60	...	53
2,061,315	,,	Mar. 6	5	5½	Newcastle & Gateshead Con.	24/6—25/6*d*	+·/6	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	100—101*d*	...	...
776,706	,,	Jan. 9	3½	3½	Do. 3½ p.c. Deb. ...	91—93*d*	+1	...
277,285	,,	May 8	5	5	Do. 5 p.c. Deb. '48...	107—109*d*	...	...
274,000	,,	Feb. 20	5	5	Newport (Mon.) 5 p.c. max.	100—102*a*	...	...
204,940	,,	Mar. 20	7½	7½	North Middlesex 6 p.c. Con.	132—142	...	...
396,160	,,	Feb. 6	5	5	Northampton 5 p.c. max. ...	103—108	...	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	114—119	...	115—118
205,162	,,	Dec. 19	8	8	Plym'th & Stonehouse 5 p.c.	157—167	+2	161—163
504,416	,,	Feb. 20	8	8	Portsm'th Con. Stk. 4 p.c. Std.	161—166	+1	163½—165
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	104—109	...	...
114,000	,,	Feb. 20	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	,,	Jan. 23	4	4	Primitiva 4 p.c. Rd. Db. 1911	80—85	...	...
389,813	,,	Dec. 19	4	4	Do. 4 p.c. Cons. Deb.	80—85	...	...
150,000	10	Mar. 20	6	6	San Paulo 6 p.c. Pref. ...	6⅞—7⅛	...	...
1,736,968	Stk.	Sept. 5	6	6	Sheffield Cons.	122—124*	...	...
95,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	91—95*c*	...	...
133,201	,,	Feb. 20	8½	5	Shrewsbury 5 p.c. Ord. ...	125—130	...	...
90,000	10	June 6	15	15	South African	3—5	...	...
6,709,895	Stk.	Feb. 20	5	7	South Met. Ord.	124—128	−1	125—126½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	136—141	−1	138—139
850,000	,,	,,	—	20/-*g*	Do. 4 p.c. Irred. Pf.	99—103	−1	...
1,895,445	,,	Jan. 9	3	3	Do. 3 p.c. Deb. ...	77—81	−1½	78—78½
1 000,000	,,	Jan. 23	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
209,820	,,	Mar. 6	8½	8½	South Shields Con.	147½—152½*d*	...	...
1,543,795	,,	Feb. 20	6	6	South Suburban Ord. 5 p.c.	124—129	...	...
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	113—118	...	115½—117
868,837	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	120—125	...	123—124
647,740	,,	Feb. 20	5	5	Southampt'n Ord. 5 p.c. max.	107—112	...	112
121,275	,,	Dec. 19	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	,,	Mar. 6	9/-	5½	Swansea 5½ p.c. Red. Pref.	108—112	...	...
200,000	,,	Dec. 19	6½	6½	Do. 6½ p.c. Red. Deb.	105—110	...	...
1,076,490	,,	Mar. 6	6½	6½	Tottenham and District Ord.	142—147	...	142—144
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	123—128	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
199,005	,,	Dec. 19	4	4	Do. 4 p.c. Deb. ...	98—103	...	...
85,701	,,	Apl. 3	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	80—85	...	...
347,769	,,	Mar. 6	7	7	Uxbridge, &c., 5 p.ct. ...	140—145	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
1,322,220	,,	Mar. 6	7	7	Wandsworth Consolidated	145—150	...	147—148½
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	...	112—113⅛
1,317,964	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	120—125	...	122⅛—123½
158,400	,,	Mar. 6	5	6⅛	Winchester W. & G. 5p.c. Con.	109—114	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—For quarter. *h.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

STOCKS AND SHARES FOR SALE.

By Order of the Directors.
GODALMING GAS AND COKE COMPANY, LIMITED.

Messrs. A. & W. RICHARDS
are Instructed to OFFER FOR SALE BY TENDER
3160 £5
FIVE PER CENT. PREFERENCE SHARES.
Minimum Price of Issue, Par.

Prospectus and Form of Tender (which latter must be sent in by 11 o'clock on Tuesday, the 13th of June) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

TROTTER, HAINES, & CORBETT LIMITED
BRETTEL'S ESTATE
FIRE-CLAY & BRICK WORKS
STOURBRIDGE

Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST FURNACE BRICKS, LUMPS, TILES, and every Description of FIRE BRICKS.

Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

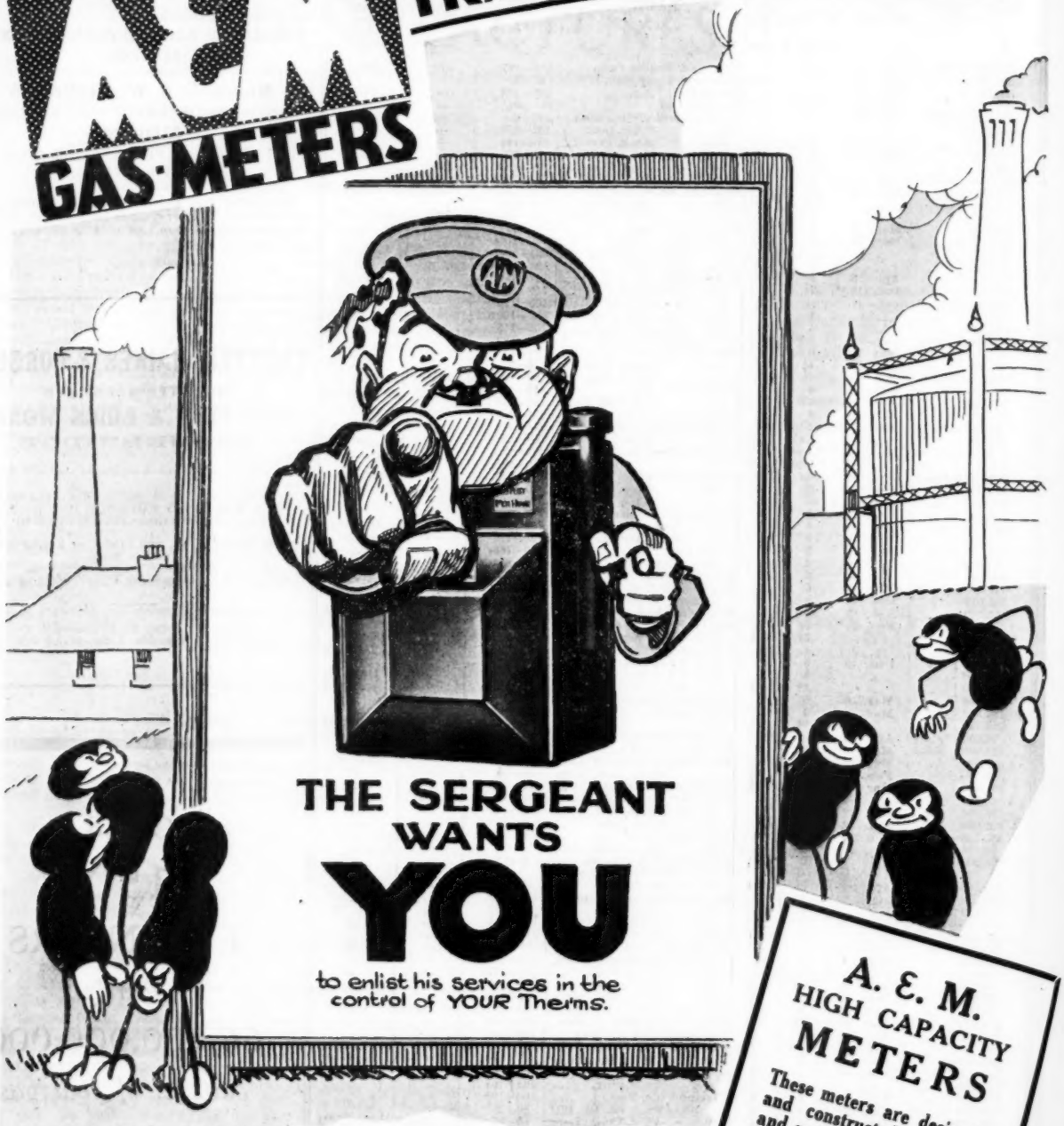
LONDON OFFICE: E. C. BROWN & CO., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

OVER
150
ENGINEERS
Purify
66,000,000,000
cub. ft. of coal gas
per annum
with
OUR
OXIDE

MANCHESTER OXIDE CO. LTD.
MILES PLATTING, MANCHESTER
Telegrams: Oxide, Manchester
Telephone { *2283* } *Collyhurst*
{ *2284* } *Manchester*

A E M GAS METERS

TRAIN THE THERMS



A. E. M. HIGH CAPACITY METERS

These meters are designed and constructed for long and exacting service under modern conditions. Pressure losses at capacity are unusually small and registration is precise over a very large range.

The new Dual Coin P.P. mechanism is the acme of simplicity. One operation to the range plate is all that is required to alter from 1d. to 1/- setting, or vice versa.

Ask for a sample of the new 100 cu. ft. Dual Coin P.P.

WILL YOU JOIN?

There is room in the ranks of A.E.M. customers for new recruits. Will you accept service? Sergt. A.E.M. Meters is ready and willing to control your Therms. His initial "E" stands for Efficiency. Join now!

ALDER & MACKAY LIMITED

MAKE METERS OF METICULOUS MEASUREMENT

ALDER & MACKAY LTD., EDINBURGH, LONDON & BRANCHES.

PUBLISHERS' NOTICE.

TO CORRESPONDENTS: No notice can be taken of anonymous communications, unless authenticated by the name and address of the writer (not necessarily for publication).

TO ADVERTISERS.

NOON ON TUESDAY is the latest hour for receipt of advertisement copy for the following day's issue.

FIRST POST ON MONDAY is the latest for receipt of alterations of standing advertisements

RATES FOR UNDISPLAYED ADVERTS: Situations Wanted, Six Lines and under (about 36 words), 3s.; each additional Line. 6d. Situations Vacant, Apparatus Wanted and for Sale. Contracts, Public Notices, &c., 9d. per Line—minimum 4s. 6d. An additional charge of 6d. is made where replies are addressed c/o the "JOURNAL."

Full Schedule of Advertising Rates on application.

TERMS OF SUBSCRIPTION.

United Kingdom and Ireland — Advance Rate: 35/- per annum, 18/- per half year. Credit Rate: 40/- per annum, 21/- per half year.

Dominions and Colonies ... 35/- per annum, in advance.

United States (through United States Agent) ... $8.50 per annum, in advance.

Other Countries in the Postal Union ... 40/- per annum, in advance.

A copy of the "G.J." Calendar and Directory is presented to Continuous Subscribers.

UNITED STATES.—Renewals after December, 1931, and all new subscriptions in the United States, to be made through ROBERT O. LUQUEER, Agent, WOOLWORTH BUILDING, NEW YORK, N.Y.

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C. 4.
Telephone: Central 2236-7 (2 lines). Telegrams: "GASKING, FLEET LONDON."

FRESH OXIDE

SPENT OXIDE

GAS PURIFICATION & CHEMICAL COMPANY LIMITED,

PALMERSTON HOUSE, 34, OLD BROAD STREET, LONDON, E.C. 2.

(ESTABLISHED 1873.)

Telegrams: "PURIFICATION, STOCK, LONDON." Telephone: LONDON WALL 9144.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.

WET AND DRY GAS METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.

REPAIRS RECEIVE PROMPT ATTENTION.

Telephones: Main (Oldham) 3815/6 and 2412 Hop, London.

Telegrams: "BRADDOCK, OLDHAM," and "METRIQUE, LAMB, LONDON."

WEIGHBRIDGES

FOR Motor Lorries and Railway Traffic can be seen erected at our Works READY FOR DELIVERY. Inspection by your Engineer invited and a test by your Local Inspector of Weights and Measures before delivery. Every machine a High-Class Engineering Product and fully guaranteed.

CHARLES ROSS, LIMITED, SHEFFIELD.

OXIDE OF IRON.

SPENT OXIDE BOUGHT.

BALE & CHURCH, LTD., 33, ST. MARY-AT-HILL, LONDON, E.C. 3. Phone: Royal 1484.

"TORTO" FIRE CEMENT.

BALE & CHURCH, LTD., 33, ST. MARY-AT-HILL, LONDON, E.C. 3. Phone: Royal 1484.

"KLEENOFF," THE COOKER CLEANSER

Tins for Sale to Consumers.
In Bulk for Works Use.
(*See also p. 705 and the "Gas Salesman."*)

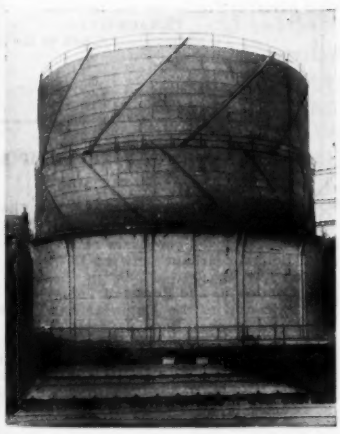
BALE & CHURCH, LTD., 33, ST. MARY-AT-HILL, LONDON, E.C. 3. Phone: Royal 1484.

GASHOLDERS OF CHARACTER

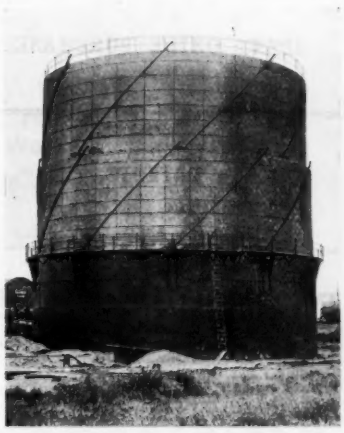
COMBINING STRENGTH AND STABILITY

FIRTH BLAKELEY PRODUCTS CAN BE DEPENDED UPON FOR LONG SERVICE

SPECIFY THE "VULCAN" BALL-THRUST CARRIAGES FOR YOUR NEXT GASHOLDER



ABSOLUTELY THE LAST WORD IN SMOOTH WORKING, STRENGTH AND SECURITY



GASHOLDERS

of every Type, Size, and Capacity

FIRTH BLAKELEY, SONS & CO. LTD.

GAS ENGINEERS AND CONTRACTORS

VULCAN IRONWORKS, CHURCH FENTON, YORKS

Telephone: No. 34, BARKSTON ASH

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Telegrams: BLAKELEYS, CHURCH FENTON *Code:* BENTLEYS

ROBERT DEMPSTER & SONS, Ltd., ELLAND, Builders of CARBONIZING PLANTS, both Horizontal and Vertical. Manufacturers of CONDENSERS, PURIFIERS, GASHOLDERS, &c., also every description of COAL and COKE HANDLING PLANT. Telegrams: "DEMPSTER, ELLAND." Telephone: ELLAND 261 (Private Branch Exchange).

FIRTH BLAKELEY, SONS, & CO., LTD.,
Vulcan Ironworks, Church Fenton, Yorks.,
MANUFACTURERS of Gasholders, Tanks, Condensers, Purifiers, Scrubbers, Washers, and every description of Gas Plant.
Telegrams: "BLAKELEYS, CHURCH FENTON." Telephone: BARKSTON ASH 34 (Private Branch Exchange). Code: "BENTLEYS."

STRACHAN & HENSHAW LTD.
MANUFACTURERS **BRISTOL.**
and CONTRACTORS for
HANDLING PLANT,
SCREENS, TIPPLERS, ETC.

HUTCHINSON BROTHERS, Ltd.,
FALCON WORKS, BARNSLEY.
MANUFACTURERS OF
GAS METERS (Ordinary and Slot).
"FALCON" INVERTED LAMPS,
SQUARE STREET LANTERNS
SUPERHEATER BURNERS, and
CONVERSION SETS for Street Lanterns.

THE BRITISH GAS PURIFYING MATERIALS CO., LTD.,
99, LONDON ROAD, LEICESTER.
Telegrams: "BRIPURIMAT, LEICESTER." Telephone: LEICESTER 59086.
NATURAL BRITISH PURIFYING MATERIAL
AN ABSOLUTELY STANDARD PRODUCT.
MOISTURE GUARANTEED 28%
SUMMER AND WINTER.
"FIRST QUALITY" DUTCH BOG ORE
As supplied to most of the Principal Gas Works in Great Britain.
SPENT OXIDE PURCHASED.

PATENTS.

PATENTS for Inventions, Trade Marks "Advice Handbooks" and Consultations free. KING'S PATENT AGENCY LTD., Director B. T. KING, C.I.M.E., Regd. Patent Agent, G.B., U.S., and Can., 146A, QUEEN VICTORIA ST., E.C. 4, and 57, CHANCERY LANE (near Pat. Off.), LONDON, W.C. 2. 47 years' refs. 'Phone Cent. 0682.

MEWBURN, ELLIS, & CO.,
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70 & 72, Chancery Lane, London, W.C. 2.
Telegrams: "Patent, London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

PUBLICATIONS.

GAS ACCOUNT CALCULATORS.

SUPPLIED either by Price per Therm or Thousand, for any specified Calorific Value, in book form, office charts, or pocket charts for Meter Inspectors, printed in clear type. Write for particulars to F. H. WAKELIN, LTD., Calculator Specialists, 354, WHEELER STREET, BIRMINGHAM. 'Phone: Northern 0989. 'Grams: Reckoners, B'ham.

APPOINTMENTS, &c., VACANT.

No. 8309.

WITH reference to Advertisement for FOREMAN FITTER under Box 8309, Applicants are THANKED, and informed that THE POSITION IS NOW FILLED.

COUNTY BOROUGH OF WEST BROMWICH.

GAS ENGINEER AND MANAGER.

THE Corporation require an Engineer and MANAGER to Take Charge of the Manufacturing, Distributing, and Sales Departments of their Undertaking.

The person appointed must be between 35 and 50 years of age, and have been trained as a Gas Engineer, and have had Experience in Hydraulic and Electrical Plant, High Pressure Gas Lighting, Vertical Retorts, must have Commercial Experience, and be fully competent to design and carry out any alterations and extensions of Works and Plant.

He will be required to devote the whole of his time to the duties of his office and to live in the Borough.

The appointment will be terminable by Three Months' Notice on the part of the Engineer and Manager.

Salary, £600 per Annum. The salary is subject to a temporary economy reduction.

Applications, with *copies* of Three recent Testimonials, on Forms to be obtained from the undersigned, to be received not later than the Twenty-Fourth day of June, 1933.

Canvassing Members of the Committee, either directly or indirectly, will be deemed a disqualification.

ALFRED WICKHAM,
Town Clerk.

Town Hall,
West Bromwich,
June 7, 1933.

COMPANY NOTICES.

THE UXBRIDGE, MAIDENHEAD, WYCOMBE, AND DISTRICT GAS COMPANY.

PUBLIC NOTICE.

NOTICE is Hereby Given that the DEBENTURE TRANSFER BOOKS WILL BE CLOSED from the 16th to the 30th June, both days inclusive, and the Interest Warrants will be paid on the 1st July next to the Debenture Holders registered at the date of closing.

By order of the Board,
GEORGE J. BRISTOW,
Secretary.

Uxbridge,
June 6, 1933.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK only, WILL BE CLOSED on the 17th instant and RE-OPENED on the 1st July, 1933.

By order of the Board,
K. LESLIE MORTIMORE,
General Manager and Secretary.

Gas-Works,
Hornsey, N. 8,
June 7, 1933.

CONTRACTS OPEN.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

TENDERS are invited for the Supply of 7000 Tons of GAS NUTS, to be delivered at the Gas-Works Sidings, Hebden Bridge Station (L.M.S.R.), in such monthly quantities as may be required during the Twelve Months July 1, 1933, to June 30, 1934.

Forms of Tender can be obtained on application to Mr. T. H. Nield, Engineer and Manager, Carlton Street, Hebden Bridge.

Sealed Tenders, endorsed "Tender for Gas Coal," must be delivered to the undersigned not later than first post on Tuesday, the 13th of June, 1933.

The Board do not bind themselves to accept the lowest or any Tender.

SAM OGDEN,
Clerk of the Board.

Carlton Street,
Hebden Bridge,
May 27, 1933.

BOROUGH OF STALYBRIDGE.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply and Erection of One Bench of INTERMITTENT VERTICAL CHAMBER OVENS.

Plans, General Conditions, and Specifications may be obtained on application to the Engineer and Manager, Gas Offices, Park Street, Stalybridge, on payment of the sum of £3 3s., which will be refunded on the receipt of a *bona-fide* Tender.

The site may be viewed by arrangement only, and further particulars obtained from the Engineer and Manager.

Sealed Tenders, endorsed "Carbonizing Plant Renewals," should be addressed so as to reach the undersigned not later than the 29th June, 1933.

Canvassing in any form, oral or written, direct or indirect, is prohibited, and the Committee are not bound to accept the lowest or any Tender.

Dated this Thirtieth day of May, 1933.

FRANK H. WORSLEY,
Town Clerk.

Town Clerk's Office,
Stalybridge.

BIRSTALL URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE above Council invite Tenders for the Supply of Good GAS COAL, Well Screened and Free from Pyrites, or for DOUBLE SCREENED WASHED NUTS, to be delivered at the London, Midland, and Scottish Railway Station, Birstall, near Leeds, or at the Gas-Works, Birstall, aforesaid, over a period of Twelve Months, commencing July 1st, 1933, and in such quantities and at such times as may be required.

Tenders, sealed and endorsed "Gas Coal," to be delivered to me not later than 10 a.m. on Friday, June 9th, 1933.

The Council do not bind themselves to accept the lowest or any Tender.

Forms of Tender are not supplied.

HORACE GRAY,
Clerk to the Council.

Council Offices,
Birstall,
near Leeds.

CITY AND COUNTY BOROUGH OF BELFAST.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply of approximately 170,000 Tons of GAS COAL, to be delivered free and trimmed in Barges at Belfast Harbour between 1st August, 1933, and 31st July, 1934.

Conditions and Forms of Tender may be had on application to the Engineer and Manager, Gas-Works, Ormeau Road, Belfast.

Tenders, enclosed in sealed envelopes, endorsed with the name and address of the firm tendering, and marked "Tender for Gas Coal, Gas Department," to be lodged in the office of the undersigned not later than Five p.m. on Thursday, 15th June, 1933.

An official receipt must be obtained for every Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any Tender will not necessarily be accepted.

The whole or any part of a Tender may be accepted.

R. MEYER,
Town Clerk.

(Continued on p. 780.)

PROGRESS OF THE "HOLMES" NEW SYSTEM OF BENZOLE RECOVERY AND WASH OIL REGENERATION

Recent orders received from Gas Undertakings

1930

Huddersfield

1931

Brighouse
Long Eaton
Lambton, Hetton & Joicey Colls. Ltd.
Calverley & Horsforth District Gas Co.
Dover
Blackburn
Gas Light & Coke Co., Fulham Works
Plymouth Gas Dept., Devonport

1932

Manchester Corp., Rochdale Road
Lytham & St. Annes
Altrincham
Dewsbury
Tottenham & District Gas Co.
Chesterfield
Ryde
Cradley Heath
Goole
Wakefield
Oldham
Colchester
Ramsgate
Newark-on-Trent
Bilston
Oswaldtwistle
Tottenham & District Gas Co., Ponders End Works
Tottenham & District Gas Co., Hertford Works
Cambridge
Bournemouth
Watford & St. Albans Gas Co.
Plymouth and Stonehouse Gaslight & Coke Co.
Nottingham
Barnsley
Swindon
Gas Light & Coke Co., Brentford Station
Gas Light & Coke Co., Nine Elms Station
Gas Light & Coke Co., Bow Common Station
Padiham
Folkestone
Sheffield
Stretford
Great Yarmouth
Guildford
Brighton
Scarborough
Barnet District Gas & Water Co.
Morley
Liverpool Gas Co., Garston

1933

(*under construction*)

Farnham
Douglas
Shanklin & Ventnor Gas Co., Shanklin Works
Portsmouth
Bishop's Stortford, Harlow & Epping Gas & E. Co., Epping Works
Bishop's Stortford, Harlow & Epping Gas & E. Co., Bishop's Stortford Works
Southampton
Tunbridge Wells
Southgate & District Gas Co.
Aylesbury
Dublin
St. Helens
Leeds Corp. Gas Dept., Meadow Lane Works
Bexhill-on-Sea
Stoke-on-Trent

Full information regarding technical details and the financial advantages of this Process will be forwarded on request.

HOLMES
FOUNDED 1850
HUDDERSFIELD

W. C. HOLMES & CO. LTD., HUDDERSFIELD

Telephone: Huddersfield 1573 (Private Branch Exchange).
Telegrams: Holmes, Huddersfield
London Office: 119 Victoria Street, Westminster, S.W.1. *Telephone*: Victoria 4505. *Telegrams*: Ignitor, Sowest, London

C96

CONTRACTS OPEN.—*Continued.*

COUNTY BOROUGH OF BLACKBURN.
(GAS DEPARTMENT.)

THE Corporation invite Tenders for the Supply, Delivery, and Erection at the Greenbank Gas-Works of a CAST-IRON EFFLUENT LIQUOR STORAGE TANK.

Form of Tender and Specification may be obtained on Application to J. D. Ashworth, M.I Mech.E., Engineer and Manager, Gas Department, Town Hall, Blackburn, and sealed Tenders, endorsed "Storage Tanks," must be received by the undersigned not later than the 22nd inst.

The Corporation do not bind themselves to accept the lowest or any Tender.

BRIGGS H. MARSDEN,
Town Clerk.

Town Hall,
Blackburn,
June 3, 1933.

TARPAULINS.

TARPAULINS.—Second-Hand Black Dressed, approx. 20 ft. by 14 ft., all thoroughly repaired, 25s. each. Redressed ditto, 30s. each. Carriage paid. Approval willingly. Thousands sold with full satisfaction. Cheapest makers new goods. Samples and lists on application.

S. H. LOMAS & CO., HIGH STREET, LONDON, E. 15.

PLANT &c., FOR SALE & WANTED.

FOR SALE—Parkinson Wet Type METER. Capacity, 2400 cu.ft. per hour. Six years old.

PATENT RETORTS, LTD., 5, VICTORIA STREET, LONDON, S.W. 1.

LET EACH CASMAN KEEP SAFE

Safety is a condition of Fitness to do work. G smen are *Safe per se* whilst at work (figs. F8, G2, P6); but if a man slips or man falls, he is Kept Safe (figs. 8 and 9) if he is using the Hanley Safety Belt Rigs. **Safety is Cheap and Profitable.**

Let each of your men use a **HANLEY** Safety Rig. Samples on appro.

From:
A. HANLEY, C 473, Queens Rd., Sheffield 2.

Telegrams: STRINGER BROTHERS WEST BROMWICH.
Telephone: 1161 WEST BROMWICH.

For the Contact Staff.

"Gas Salesman"

PUBLISHED MONTHLY. ANNUAL SUBSCRIPTION, 6/-.

Special Rates for Bulk Supplies for distribution among Gas Service Staffs.

WALTER KING, LTD., 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4

"TEL. ADDRESS: TOOLS DENTON LANCS" TELEPHONE 2038

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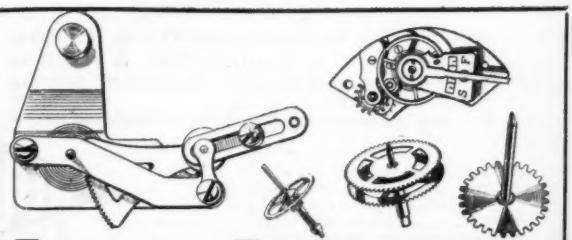

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B

Baldwins, Ltd.	658
Bale & Church, Ltd.	705, 777
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Braddock, J. & J.	Wrapper II., 777
Bray, George, & Co., Ltd.	—
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British Furnaces, Ltd.	650
British Gas Purifying Materials Co.	778
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Broadbent, Thos., & Son, Ltd.	—
Broadhead Constructions, Ltd.	Wrapper I.
Bugden, T., & Co.	—

C

Cambridge Instrument Co., Ltd.	—
Cannon Iron Foundries, Ltd.	Centre IX.
Carron Company	—
Cellactite & British Uralite, Ltd.	—
Chemical Engineering and Wilton's Patent Furnace Co., Ltd.	Wrapper I., 686
Clapham Bros., Ltd.	641
Clayton, Son, & Co., Ltd.	684
Cochran & Co., Annan, Ltd.	—
Cookers & Geysers, Ltd.	657
Cort, Robert, & Son, Ltd.	696, 697
Cowan, W. & B.	Wrapper III.
Crane, Ltd.	691
Crone & Taylor, Ltd.	646
Cutler, Samuel, & Sons, Ltd.	Centre XVIII.

D

Davis Gas Stove Co., Ltd.	—
Dempster, R. & J., Ltd.	772
Dempster, R., & Sons, Ltd.	Centre II., 778
Denison, Saml., & Son, Ltd.	668
Diaphragm & General Leather Co., Ltd.	—
Donkin Co., Ltd. (The Bryan)	Wrapper II., 647
Dougall's Gas Meters, Ltd.	659
Drayton Regulator and Instrument Co., Ltd.	—
Dry Gasholders, Ltd.	688
Duxbury, Thomas, & Co.	Wrapper I., 645

E

E. B. Refractory Cement Co., Ltd.	—
Economic Gas Boiler Co., Ltd.	—
Electrolux, Ltd.	—
Evans, Joseph, & Son (Wolverhampton), Ltd.	Wrapper IV.
Ever Ready Co. (Great Britain), Ltd.	—
Expanded Metal Company, Ltd.	—

F

F. C. Construction Co., Ltd.	669
Falk, Stadelmann, & Co., Ltd.	679
Fletcher, Russell, & Co., Ltd.	—
Foster, E., & Co.	Centre VI.
Foster & Pullen, Ltd.	—
"Four Oaks" Spraying Machine Co.	662
Fraser & Chalmers Engineering Works	—

G

Gas Chambers and Coke Ovens, Ltd.	Centre XIII.
Gas Meter Co., Ltd.	Wrapper IV., 673
Gas Purification and Chemical Co.	Wrapper I., 643, 777
General Gas Appliances, Ltd.	715
Gibbons Bros., Ltd.	680
Gibbons (Dudley), Ltd.	681
Glenboig Union Fireclay Co., Ltd.	Wrapper II.
Glover, George, & Co., Ltd.	Wrapper I., 702
Glover, Thos., & Co., Ltd.	655, 716
Goodall, Clayton, & Co., Ltd.	676
Grant, David, & Co.	706
Graphite Products, Ltd.	663
Gray, Jas. & Sons	—
Green & Boulding, Ltd.	—
Griffiths Bros. & Co. (London), Ltd.	Wrapper I.

H

Hailwood & Ackroyd, Ltd.	687
Hanley, A.	780
Hardy & Padmore, Ltd.	—
Harper, John, & Co., Ltd.	653
Harper & Moores Firebrick Co., Ltd.	706
Harris & Pearson, Ltd.	641
Hawkins, W. T., & Co.	Centre VI.
Head, Wrightson, & Co., Ltd.	682
Holmes, W. C., & Co., Ltd.	779
Horseley Bridge and Engineering Company, Ltd.	669
Horstmann Gear Company, Ltd.	703
Humphreys & Glasgow, Ltd.	714
Huntington Heberlein & Co., Ltd.	670
Hurry Water Heater Co.	687
Hutchinson Bros., Ltd.	778

I

Incandescent Heat Co., Ltd.	700
Institute of Chemistry	—

J

Jenkins, W. J., & Co., Ltd.	695

K

Keith, James, & Blackman Company, Ltd.	782
King, Walter, Ltd.	708, 780
King's Patent Agency	778
Kirkham, Hulett, & Chandler, Ltd.	672
Kleenoff Co.	705, 777

L

Laidlaw, R., & Son (Edin.), Ltd.	—
Lead Wool Company, Ltd.	Centre VI.
Le Bas Tube Co., Ltd.	—
Leroy, F., & Co. Ltd.	—
Lighting Trades Ltd.	683
Lomas, S. H., & Co.	780
London Electric Firm, The	Wrapper II.

M

Macpherson, Donald, & Co., Ltd.	—
Main, R. & A., Ltd.	Centre X., XI.
Manchester Oxide Co., Ltd.	775
McKelvie, James, & Co.	Wrapper I.
Meltham Silica Firebrick Co., Ltd.	644
Metropolitan Gas Meters, Ltd.	693
Mewburn, Ellis, & Co.	778
Milne's Meters, Ltd.	678
Mining & Industrial Equipment, Ltd.	—
Mitchell, H., & Co.	Wrapper I., Centre XII.
Morris Commercial Cars Ltd.	671

N

National Benzole Co., Ltd.	—
National Enamels, Ltd.	652
New Conveyor Co., Ltd.	709
Newton Chambers & Co., Ltd.	—
Nobel Chemical Finishes, Ltd.	661
Nortons (Tividale), Ltd.	—

O

Orme, George, & Co.	654
Oughtibridge Silica Firebrick Co.	—
Oxley Engineering Co., Ltd.	—

P

Parkinson Stove Co., Ltd.	Centre III.
Parkinson, W., & Co.	Wrapper I., 656, 716
Pass, E., & Co.	780
Patent Retorts, Ltd.	—
Peckett & Sons, Ltd.	641
Peebles & Co., Ltd.	660
Pegson, Ltd.	712
Piggott, Thos., & Co., Ltd.	669
Potterton, T. (Heating Engineers), Ltd.	Centre VII.
Pulsometer Engineering Co., Ltd.	—
Purimachos Ltd.	698

R

Radiation Ltd.	Centre IV., V., 651, 667, 675, 711
Reavell & Co., Ltd.	712
Richmonds Gas Stove Co., Ltd.	—
Ride and Bell, Ltd.	700
Robinson, J. H., & Co. (L'pool), Ltd.	707
Ross, Chas., Ltd.	777
Rotary Meter Company, Ltd.	—
Rotherham & Sons, Ltd.	780
Ruscoe, John, & Co., Ltd.	—

S

Sawer & Purves.	—
Scientific and Projections, Ltd.	699
Scottish Tube Co., Ltd.	—
Sheepbridge Coal and Iron Co., Ltd.	—
Siebe, Gorman, & Co., Ltd.	—
Simon-Carves, Ltd.	684
Sisson, W., & Co., Ltd.	—
Smith Meters, Ltd.	—
Solent Engineering Co., Ltd.	—
South Metropolitan Gas Company	—
Southerton, Jas., & Son	682
Spencer-Bonecourt, Ltd.	666
Sperryn & Co.	670
Stanton Ironworks Co., Ltd.	773
Staveley Coal and Iron Co., Ltd.	690
Stein, J. G., & Co., Ltd.	692
Stewarts and Lloyds, Ltd.	674
Strachan & Henshaw, Ltd.	778
Stringer Bros.	780
Sugden, F. C., & Co., Ltd.	666
Sugg, Wm., & Co., Ltd.	701
Sutherland, A. G., Ltd.	677
Sutherland Meter Co., Ltd.	710

T

Thompson, J. (Wolverhampton), Ltd.	—
Tilley Bros., Ltd.	—
Torbay Paint Company, Ltd.	—
Trier Bros., Ltd.	Wrapper IV.
Trotter, Haines, and Corbett, Ltd.	775
Tully Sons & Co., Ltd.	706
Turbine Furnace Co., Ltd.	—
Turner, F. (Art Metal), Ltd.	—

V

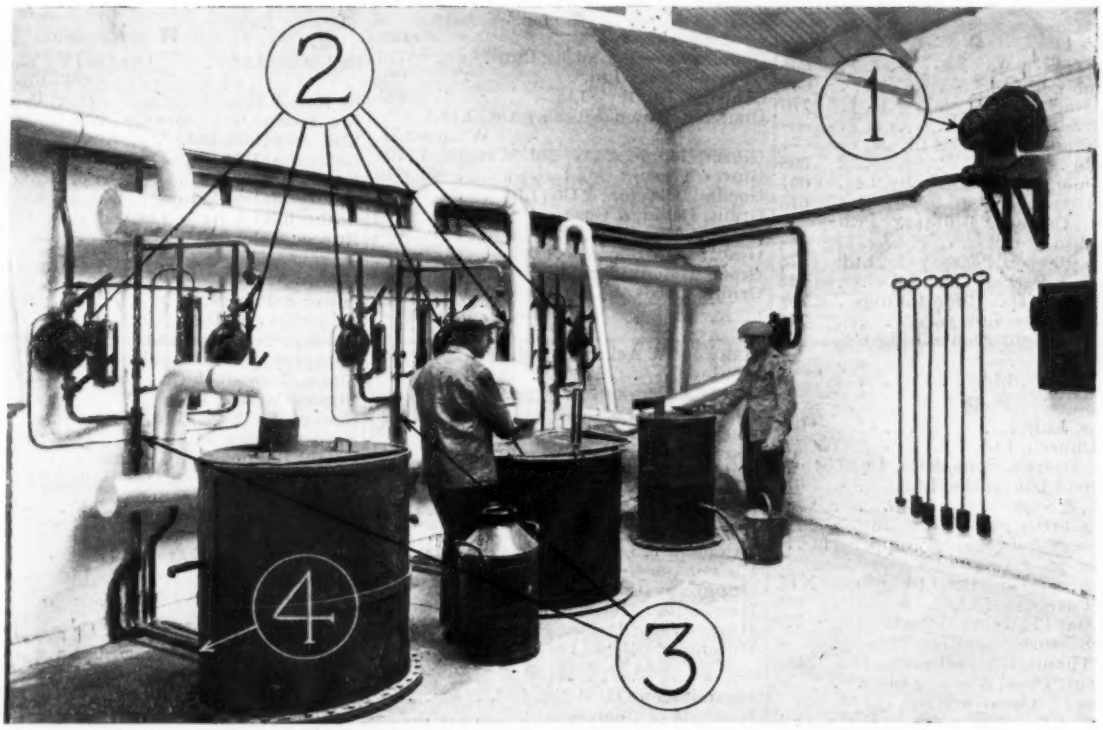
Vale, Thos., & Co., Ltd.	694
Valor Co., Ltd.	698
Vertical Gas Retort Synd., Ltd.	Wrapper I.
Vickers-Armstrongs, Ltd.	—
Visco Engineering Company, Ltd.	—
Vulcan Stove Co., Ltd.	—

W

Wakelin, F. H., Ltd.	778
Walker, C. & W., Ltd.	668
Walker, Crosweller, & Co., Ltd.	—
Waller, Geo., & Son, Ltd.	642
Waterless Gasholder Co., Ltd.	—
Wellington Tube Works, Ltd.	Wrapper IV.
Welsbach Light Company, Ltd.	683
West's Gas Improvement Co.	Centre XIV., XV.
Westwood & Wrights, Ltd.	704
Whessoe Foundry and Eng. Co., Ltd.	648, 649
Willey & Co., Ltd.	Centre VIII.
Williamson Cliff, Ltd.	—
Wilson (George) Gas Meters, Ltd.	689
Wilsons & Mathiesons, Ltd.	711
Winn & Coales, Ltd.	712
Withinshaw, A.	—
Woodall-Duckham Co., Ltd.	Centre I., XVII.
Wright, Alex., & Co., Ltd.	Centre XVI.
Wright, John, & Co.	—

Agencies	—
Appointments Vacant and Wanted	778
Company Notices	778
Contracts Open	778, 780
Patents	778
Plant, &c., for Sale and Wanted	780
Publications	778
Stock Issue	775
Tarpaulins	780

ADVERTISEMENT INDEX



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